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Soap Technology

THE accepted explanations of many of the reactions occurring during soap manufacture were questioned by Dr. E. Lester Smith in a paper, read before the London Section of the Society of Chemical Industry at the beginning of this month, entitled "Saponification in Colloidal Systems." Dr. Smith tilted against what he termed three fallacies in technical literature concerning the conversion of oils into soaps. There is a commonly held belief that glycerides as such can be saponified by alkalies. Dr. Smith maintains that upon heating a mixture of caustic soda, alcohol, and a glyceride, the soda acts as a catalyst only, and that the main action is the formation of glycerine and ethyl glyceride, followed by resolution into glycerine and alcohol, the presence of the alcohol causing a considerable increase in the velocity of the reaction. There is also a belief that sodium ethylate is a strong hydrolytic agent. Here Dr. Smith points out that water must be present, since anhydrous sodium ethylate cannot saponify.

Perhaps the most cherished belief of the three that Dr. Smith endeavoured to dispel was that saponification is a reaction that occurs at the interfaces between the fat and the aqueous, or alcoholic, solution. He stated that several lines of argument militate against this view, one in particular being indicated by the course of the reaction. Saponification reactions are generally autocatalytic in behaviour. There is a period of perhaps 25 minutes during which the reaction velocity is very slow indeed, but by the end of this time it has gathered sufficient way to cause the rate of reaction to become some 200 times as great as that during the initial period; after another period, which perhaps may also not be much greater than 25 minutes, the reaction slackens, and the curve rather rapidly approaches the horizontal.

The salient fact is that the reaction velocity during the greater portion of the reaction is 200 times that during the initial stages, and this relationship does not appear to be affected by the rate of stirring. If the saponification were an interface reaction the obvious explanation would be that the globules had been subdivided so that their surface was now 200 times that which existed in the early stages. Calculation shows that for this to occur, since the total volume of oil remains constant, the number of globules must be increased in the proportion of $1 : 200^3$. This emulsion in Dr. Smith's view would be so fine that it could not be stabilised, and he believes that the reaction is, in fact, homogeneous, and does not take place only on the surface. It must be recorded that as against this view, Professor Adam pointed out that the surface might be that of the micelles, and not of the globules.

Those who are not soap technologists would be interested in Dr. Smith's explanation of the peculiar properties of soaps. These, he said, were due to the fact that the molecules possessed a long paraffin chain at the one end which was repellent to water, and a dissociated carboxyl group at the other end which was attracted by water, so that in a sufficiently long molecule it was possible for the requirements of each end to be satisfied simultaneously, thus explaining the fact that soaps have simultaneously both solvent and detergent properties.

A number of most interesting curves were given, based on the triangular diagram, the vertices of which represent 100 per cent. soap, water, and sodium chloride respectively. It is shown, for example, how when proceeding along the water-soap axis, starting with 100 per cent. water, up to quite a considerable concentration of soap, the solution is isotropic and, therefore, homogeneous. During the next period in the concentration middle soap is deposited; over a short period there is a mixed soap which merges into a neat soap; another period of mixed soap leads into the final stage when curd soap only is deposited when the soap concentration is approaching 100 per cent. These zones are modified to some extent by the presence of salt.

Dr. Smith showed that by the aid of these diagrams explanations could be given of all the physical reactions which take place during the operation of soap boiling, and he pointed out the interesting fact that the theoretical knowledged gained by the united researches of many workers into the theory of soap boiling had shown that the rule-of-thumb practice of the practical soap boiler was actually the very best that could be suggested. It might appear, therefore, that the researches described have been of little value, but such a view is very short-sighted. There can be no doubt that the practical art of soap boiling must be all the less liable to mistakes and losses if the procedure is understood thoroughly. There was, moreover, no knowing at the beginning whether these researches might not have led to fundamental improvements, and from that angle at least they have saved would-be inventors a good deal of time and money. There is, further, no deciding whether in the future some modification of the now standard procedure might not be made, the practice of which will call for the scientific application of this work. Dr. Lester Smith's own researches have evidently been profound and have been based on that most important rule that what is "accepted" is not necessarily true until it has been proved. His novel ideas on saponification in colloidal systems have formed a considerable contribution to our knowledge of the subject, the value of which, like the results of most fundamental research work, can only be assessed truly by the light of subsequent investigation.

Notes and Comments

Talk of Slump Denounced by the Prime Minister

COULD anything be more sensible and at the same time more decisive than the Prime Minister's reply to a private member's question in the House of Commons on Tuesday? Mr. Chamberlain was asked whether he could now make a statement of the Government's policy " to meet the serious unemployment problem that threatened the country in view of the on-coming slump." With all the emphasis at his command, Mr. Chamberlain replied that he did not accept the implication in the question, and considered that the talk of an on-coming slump was not only exaggerated but dangerous. He declared that, in any event, " this country is in a far better position to meet any temporary decline in trade than at any time since the war." It may be hoped that the last has been heard of a political agitation of a peculiarly vicious kind.

One Hundred Years in Steel

THE present year marks the centenary of Thos. Firth and John Brown, Ltd., and to commemorate the occasion the company has issued a most attractively produced and well illustrated book which gives an account of the history and progress of the firms of John Brown and Co., Ltd., and Thos. Firth and Sons, Ltd. It is a fascinating story of great achievements in a time when the rapid development of the engineering world was making a constant call on the resources of the iron and steel industry. As in all industries, not only do the manufactures of a steel maker vary from time to time with the needs of the engineer, but they depend also on the technical facilities available, and the economic conditions of production. This is well brought out by a consideration of the types of steel which the company has produced during its history. For example, in 1860 John Brown and Co. laid down extensive plant for the production of steel by the new Bessemer process, while thirty years later Thos. Firth and Sons reached their maximum production of crucible steel. To-day, however, the acid Bessemer process has been superseded for the production of carbon steels by the Siemens process and the crucible by the electric furnace for the manufacture of fine test steels and the highest quality engineering and alloy steels.

Anglo-American Trade Negotiations

AN important phase has now taken place in the preliminary negotiations between this country and America relative to the proposed trade agreement. The Prime Minister has received a comprehensive statement from the Federation of British Industries setting out the views of the whole of the organised industry of the country. The statement opens by pointing out that if an understanding is to be firm and lasting, it must be to the mutual advantage of both the parties concerned. It is therefore essential that it should be preceded by a frank and full discussion of the difficulties on both sides. The Federation then puts forward those difficulties which confront the British industrialist. Chief among these is the serious damage caused by undermining of the present system of preferential inter-imperial trade, which has been established by a tariff system under the Import Duties Act. Emphasis is also laid on the danger to British industry, at the present time, of any rigid stabilisation of tariff levels. Some of the special circumstances which make it desirable for the United Kingdom to retain freedom of action are presented. In conclusion the Federation states categorically that, from the purely industrial point of view, the difficulties as set forth in the statement, make it inadvisable to enter into any agreement involving a reduction or stabilisation of British tariff rates at the present time. This is rather crabbing. It is fundamental to international trade agreements that the parties concerned are prepared to make certain concessions and it is the adjustment of these reciprocal concessions, in such a way as to result in mutual benefit, which forms the very aim of negotiation. By being prepared to make no concessions ourselves there will be no object for negotiation, and consequently the proposed agreement must die still-born.

Laboratory Planning

TO give satisfaction any laboratory must be efficiently planned and in this connection a works laboratory needs greater attention than a research laboratory. Cleanliness is of major importance and must be attained to a greater degree than would be apparent from a visit to any twelve laboratories selected at random in any corner of the country. An equable and constant temperature is also desirable, together with a maximum amount of natural daylight without the intrusion of direct sunlight. Easy access to various sections of the manufacturing plant, and also to the administrative departments, is also needed, because the laboratory is the eye which sees that the plant as a whole is running smoothly in an indicated direction. To obtain cleanliness the building must be situated sufficiently far from the dirtiest part of the works to prevent accumulation of grime or fumes; desirable positions are selected with due knowledge of the prevailing winds and dust-carrying air currents from points where loading and unloading is carried on.

Constructional Details

THE provision of a maximum amount of daylight is ensured by avoiding the close proximity of high buildings and an irritating maze of plant pipework passing from one building to another above eye level. Windows facing the north or the east generally give the best natural lighting effects. In addition, the selected situation should not be subject to vibration, as this is irritating to the accuracy of the work which is being carried out. The material of which the walls are constructed requires special consideration from a constructional point of view, but the colour of the wall surface is equally important because a light colour assists in diffusing natural as well as artificial illumination. Ceiling and walls are most satisfactory when covered with a white paint, which must be of a zinc oxide or non-darkening type. An internal facing of white glazed bricks or tiles may be preferred in certain cases, because such a surface can be washed down very easily without any loss of its whiteness. White tiling, indeed, has a special advantage over white paint, because any painted surface will gather dust and dirt and have need to be renewed periodically due to a gradual darkening; in addition, white tiling gives the best protection against acid fumes.

Search for Sources of Eugenol

AT the instigation of Netherlands and other European chemical interests, the competent services of the Netherlands Indies Government are now conducting experiments to determine whether the Netherlands Indies may become a dependable source of reasonably priced vegetable raw materials or extracts containing eugenol, an essential in the manufacture of vanillin. Fields of search include cloves, cinnamon-leaf oil, and pimentos.

Research on the Utilisation of Coal

Annual Report of the Fuel Research Board

THE report of the Fuel Research Board, with the report of the Director of Fuel Research, for the year ended March 31, 1937 (Stationery Office, 3s. net), gives a broad survey of the fuel research programme showing its relationship to the requirements of the industry, and also details of the work in hand and progress made during the period under review. The work described has been carried out at the Fuel Research Station at East Greenwich, in coal survey laboratories in different coal-mining centres, and in certain university and private laboratories.

Production of Tar or Oil

The production of tar or oil from coal has been one of the main problems under investigation at the Fuel Research Station since its establishment. There are three types of process for this purpose—(i) carbonisation, (ii) hydrogenation, and (iii) synthesis from carbon monoxide and hydrogen. Carbonisation differs from the other two processes in that the oil produced is necessarily a by-product, the main product being either coke or gas. Increased production of tar requires an increased demand for coke or gas by the metallurgical industry on the one hand, or by the household and industry on the other.

Carbonisation of coal has been practised for over 100 years, and the gasworks and coke oven industries provide about 40,000,000 gallons a year of "benzole," most of which is used as motor spirit. By lowering the temperature of carbonisation the coke becomes more free burning, the yield of tar increased and the yield of gas diminished. Even so, however, the yield of tar seldom exceeds 20 gallons per ton of coal, including about 2 gallons motor spirit obtained from the gas. The tar may yield one or two gallons of motor spirit on distillation, and the remainder can be used as a fuel oil, though it has a lower calorific value than petroleum fuel oils and suffers from the practical disadvantage that it is not miscible with petroleum oils.

By further treatment the tar can be converted into motor spirit, or separated into fractions to give an oil which, if treated with suitable "dopes" or mixed with petroleum oil, can be used in high-speed diesel engines; a satisfactory fuel oil can also be obtained. Products can also be obtained that are of value for purposes other than as fuel. This additional treatment, however, adds to the cost of the products. The main product from the "low temperature" carbonisation of bituminous coal is necessarily the coke, which, with a suitable coal and process, is a smokeless fuel for burning in the ordinary domestic open grate. Any extension of its use for this purpose in substitution for coal will reduce the smoke discharged to the atmosphere.

Low Temperature Carbonisation Tests

The narrow brick continuous vertical retorts developed at the Fuel Research Station for carbonisation at temperatures of 600° to 700° C. have continued to work satisfactorily during the year using a variety of different coals. The setting of six retorts of this design, erected by the South Yorkshire Chemical Works, Ltd., at Parkgate, near Rotherham, have been working successfully during the past year, and the company has decided to build an extension of six retorts. The possibility of carbonising cannels and shales for the production of oil is being continually examined.

In 1924, with a view to encouraging the development of plants for the low-temperature carbonisation of coal, the Government authorised the Department of Scientific and Industrial Research to undertake, without charge, tests of such plants developed by firms and individuals.

The reports on these tests place in the hands of those interested accurate technical data on the quality and quantity of the yields, the throughput of the plant, the working temperatures, and the general ease of working, together with such other information as it may be possible to obtain under the limited conditions of the tests. No attempt is made to pronounce on the commercial possibilities of the plants. The likelihood of commercial success can only be judged after working the plant under a steady load for a long period so as to obtain information on the cost of operation and upkeep, and in the light of complete knowledge of local conditions such as the cost of raw material, the quantity of raw material available, the price and market for products, etc. During the tests the plants are worked by the owners, who decide on the raw material to be used and the temperatures, throughputs and other conditions of running.

In a carbonising process the size of the carbonising unit has a marked effect on the yields, especially on the yield of tar. It is consequently a condition of test that the plant "is of such a size that its performance will be comparable with that of a similar plant on a commercial scale." The effect of size may be illustrated by reference to the Gray-King assay apparatus which has been devised at the Fuel Research Station to enable the possible yields from particular coals to be compared and assessed. In this apparatus 20 grams of coal are carbonised in a static charge, and the conditions adopted are those which give a maximum yield of tar. The yields of tar obtained in commercial-sized plants vary from 40 to 75 per cent. of the assay figure, depending on carbonising conditions.

Previous to the year under review eleven plants had been tested under this scheme (two of them twice), and thirteen reports on them had been published. During the past year four further tests have been carried out and the reports have either been published or are in an advanced stage of preparation. Three of these tests illustrate a recent development in carbonisation, *viz.*, the carbonisation of a mixture of powdered coal with oil, tar or tar distillates. This had been suggested as long ago as 1921, and a number of variations of the technique have been investigated (on a small scale) at the Fuel Research Station since that date.

Yield of Distilled Spirit

It was originally claimed that by distilling such mixtures a higher yield of tar or spirit, or both, was obtained than when the coal and oil or tar were distilled separately. It is a known fact that when an inert gas is passed through an oil during its distillation a greater proportion of the oil can be distilled off up to a given temperature, and, when this effect was allowed for, no evidence could be found of any enhanced yields of tar from the coal. It does not follow that there are no advantages to be gained from carbonising such mixtures. The process will involve a certain amount of cracking of the tar or oil used, and so may alter the character of the liquid products. The pitch or heavy residue of the tar or oil used may improve the quality and strength of the coke, particularly when a coal is used that will not by itself give a robust coke.

Other work in hand in connection with the carbonisation of coal deals with the effects of blending weakly caking coal with strongly caking coal or pitch,, and the addition of coke breeze to a strongly caking coal. This work is being carried out in intermittent vertical ovens of a commercial type and size.

In the last report mention was made of a successful investigation into the production, from coal, of an active carbon. The product is not necessarily suitable for all purposes, but a considerable number of firms are investigating the active carbon for such purposes as solvent recovery, sugar refining, and oil refining.

The technique of hydrogenation has in the past been investigated largely in order to develop a process by means of which the highest yield of motor spirit could be obtained from low-temperature tar or from coal. The amenability of different tars and coals to the treatment has been investigated. During the past year a process has been devised for the treatment of vertical retort tar, and knowledge of the behaviour of different types of coal in relation to hydrogenation has been extended.

Technique of Hydrogenation

Recently one part of the work has undergone a change, and the aim of this work is now to study the technique of the hydrogenation process in order to elucidate the constitution of coal and to produce more diverse products from the raw materials available. In the light of fuller knowledge of catalysts gained by investigations in Professor Rideal's laboratory at Cambridge and at the Fuel Research Station, a more exact control of the reactions has become possible. In the past the motor spirits produced have contained a rather low proportion of volatile constituents, but it has now been established that, by the choice of a suitable catalyst and the best operating conditions, spirit containing a high proportion of volatile hydrocarbons can be produced. This light spirit is rich in paraffin hydrocarbons and low in aromatic hydrocarbons, but its octane number suggests that the paraffins are of the iso-type.

It will be seen that hydrogenation technique may come to lend itself to wide variations, both in conditions of experiment and in the properties of the products. it is desirable, therefore, that the mechanism of the reactions involved should be more closely studied and be related to the constitution of the original materials. The production of paraffin hydrocarbons containing many branch chains will provide a source of spirit of high octane number, and research is in progress with a view to obtaining long chain hydrocarbons which will provide suitable raw material for the production of lubricating oils.

The Fischer-Tropsch Process

The synthesis of liquid hydrocarbons from mixtures of carbon monoxide and hydrogen, first developed by Fischer and Tropsch, provides a method of obtaining large yields of oil from coal without the use of high pressures. During the past two years, experiments on a laboratory scale have been made to establish the technique of the synthesis. They reached the stage at which it was possible to design a larger plant to produce 10 litres of hydrocarbons a day. This plant has been erected and was brought into operation towards the end of the year.

Another line of research, laid down when the Board was formed, was an investigation into the physical and chemical characteristics of the various coals as they occur in the ground. The coals vary greatly in their properties, and individual seams may vary rapidly from point to point as well as being composed of layers having very different properties. A detailed knowledge of the coals available is essential if they are to be used to the best advantage. The investigations in the coalfields are carried out from eight laboratories, staffed by the Department.

For investigations on a larger scale than is possible in the survey laboratories, the necessary work is carried out at the Fuel Research Station, where much of the work really forms part of the survey. Large-scale experiments, especially as regards coal breaking, are also carried out at collieries under the supervision of the survey staff.

The general analytical reports on the coals are of two types: (a) Dealing with the examination of pillar samples cut from the seam under investigation; these show the variations that occur vertically in the seam at each point sampled, and the changes that take place over the field. (b) Giving analyses of the various grades of coal produced at the different collieries; these commercial grades may be "run of mine" coal from one seam, but are more often only portions of a seam, or mixtures of coal from different seams. The examination of the pillar sections is the foundation of the work of the coal survey, as by this means alone is it possible to get a true picture of the coal as it occurs in the ground.

There are many cases where a particular portion of the seam is high in sulphur, or has some other property which is undesirable for the purpose for which the coal is, or might be, used. Examination of the pillar sample shows whether such a portion exists and whether, as is often the case, the seam can be worked so as to separate out the inferior coal. An example may be quoted where complaints were received of excessive phosphorus in a coal. Investigation showed that the coal itself was low in phosphorus, and that the excessive amounts found were due to contamination by small quantities of floor and roof.

Some seams contain material which has the appearance of an inferior coal, but which is, in reality, of excellent quality. The investigation of such cases by the unbiased authority of the Coal Survey has removed selling difficulties in such cases. On the other hand there may be more or less local inclusions of material that while not differing appreciably in appearance is actually inferior. The survey has shown how these inferior portions can be separated so as to maintain the quality of the product placed on the market. An increasing number of collieries are now equipped with laboratories, and maintain a chemist on the staff.

Methods of Analysis

The efficient conduct of the survey necessitates continual investigation on the constitution of coal and on methods for its examination. The Fuel Research Station and the Coal Survey Laboratories are in close touch with the British Standards Institution and with private analysts with a view to improving the methods of analysis of coal. The methods of analysis adopted in the survey have been described in Survey Paper No. 7, but this is in some respects out of date and a revised report is being issued as Survey Paper No. 44.

The commercial application of the "Grid" and the "Multijet" burners designed at the Fuel Research Station continues to extend. It has been found possible, using a "Grid" burner on a Lancashire boiler with a suitable coal, to maintain overloads of 100 per cent. and more above the rated capacity for hand firing. In the detailed study of the burners the best arrangement of the brickwork has been studied and has been found to depend largely on the type of coal being used. This is an interesting observation from a practical standpoint.

One of the main disadvantages of pulverised coal lies in the amount of grit or "fly" ash that may be discharged from the chimney. Experiments are being carried out to determine the uniformity of flow of the gases in boiler flues and how it can be influenced so that the samples obtained from the flue gases may be representative of the flue gas as a whole. This work was undertaken to assist a committee of the British Standards Institution in preparing a specification for testing dust extraction plants, but was of importance in relation to the work in progress at the station. Experiments are also being carried out with a view to designing a plant, for the extraction of dust and sulphur from flue gases, which can be applied to small installations.

HIGHER FATTY ALCOHOLS HAVE BEEN PREPARED in good yield by the sodium-ethyl alcohol reduction of esters by Mitchovitch and Stefanovitsch (*Compt. rend.* 1937, *206*, 386). Equally good yields were obtained when starting from ethyl esters (*e.g.*, ethyl oleate) and glycerides (olein, palmitin, etc.). The method could also be applied to the reduction of olive oil and other natural glycerides. According to the investigators a yield of 60 to 90 per cent. is possible when observing the following precautions: Complete freedom from water of the ethyl alcohol and the glyceride, complete solution of the fatty substance, vigorous stirring, rapid introduction of the sodium, and maintenance of the ethyl alcohol at the boiling point throughout the operation.

Chemical Matters in Parliament

Oil Extraction

IN the House of Commons on December 14, Mr. George Hall asked the Secretary for Mines whether he would give a list of the plants and the processes in operation for the production of oil from coal in this country, together with the amount of coal carbonised and oil produced in each process?

In reply, Captain Crookshank circulated the following answer: Out of a total of 85,000,000 gallons of motor spirit produced in 1936 from coal and by-products of coal, 51,000,000 gallons were obtained from several hundred gas works and coke-oven installations, at which a total of about 39,000,000 tons of coal were carbonised. Of the balance, 33,300,000 gallons were obtained at the Billingham hydrogenation plant, and in this connection, 425,000 tons of coal were used. 800,000 gallons were produced at low-temperature carbonisation plants, at which 364,000 tons of coal were carbonised. 95,000,000 gallons of heavy oils were produced, of which 89,000,000 gallons were obtained from gas works and coke ovens, and just over 6,000,000 gallons from low-temperature carbonisation plants.

Mr. Hall asked the Secretary for Mines whether he would give a statement showing the countries which have oil from coal plants in operation; and the processes used, together with the amount of coal carbonised and the amount of oil produced in each country?

In reply to this question Captain Crookshank said that apart from this country, plants for the production of oil from coal by the hydrogenation, synthesis or low temperature carbonisation processes are understood to be operating in Germany, France, Japan and the United States of America. Oil is also produced in these and many other countries by high temperature carbonisation. No reliable information is available regarding the quantities of coal carbonised and the quantities of oil produced by the processes named in each country.

Mr. Hall: Will the Minister give the information which he has at his disposal?

Captain Crookshank: As it is so unreliable, I hardly like to do that.

In the House of Lords on Wednesday, the Duke of Montrose asked the Government whether in the event of war they were now satisfied that there would be sufficient supplies of petrol, fuel and diesel oil in this country, and whether the Government had any definite plans for alternative supplies of power derived from fuel produced from home sources. He said that oil supplies were the be all and end all of our national defences. In the event of war we should require at least 3,000,000,000 gallons of oil.

Earl De La Warr, Lord Privy Seal, pointed out that in a matter of this kind, involving some of the most intimate details of our defence arrangements, it was not easy for him to be as definite as the Duke of Montrose would wish. "But," he added, "the Government do attach the greatest importance to this subject." We have got to face the fact that whatever is done with regard to alternative supplies we are never in fact going to be able to produce all our requirements in this country or anything like all. Nevertheless the Government had felt that it was most important that they should do all that was possible, for instance, with the production of oil from coal.

New Oil from Coal Works

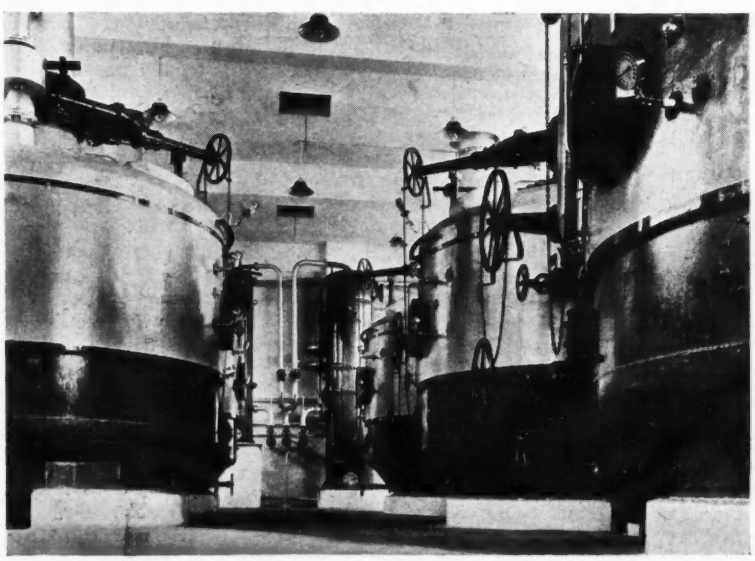
Earl of Dunraven lays Foundation Stone

THE Earl of Dunraven, on Thursday, laid the foundation stone of the new works to be set up on the edge of the South Wales coalfield, at Wern Tarw, Bridgend, by the South Wales Coalite Co., Ltd. The Government and the Nuffield Trust have provided half the required capital of £650,000 for this undertaking, which is the first to be established in a Special Area.

The plant is expected to be working by the autumn of 1938, and already contracts have been placed for several hundred thousand pounds. It will produce smokeless fuel, petrol, diesel oil, tar acids and other by-products, by low temperature carbonisation. Two collieries near the works on the edge of the South Wales coalfield in the Vale of Glamorgan, Wern Tarw and Raglan, 2,000 acres in extent, will supply the coal, which extensive tests have shown to be suitable for treatment by low temperature carbonisation.

Tests were carried out in Wales by Mr. F. B. Kerridge, formerly Inspector of Mines in South Wales, and assistance was given by Sir Richard Redmayne, formerly Chief Inspector of Mines for Great Britain. Laboratory work and full scale tests were simultaneously carried out at the low temperature carbonisation plant near Barnsley.

The new works will comprise a carbonising plant similar to the one opened by the Duke of Kent at Bolsover in Derbyshire this year; a coal-oil distillation plant covering about 30 acres for the production of aviation petrol, diesel oil, fuel oil and other derivatives; and a large plant for the manufacture of tar acids and other chemical products. Between 500 and 750 tons of coal will be used per day. According to the seams worked, the yields per ton of coal will be 14 cwt. of coalite and from 20 to 25 gallons of oil and petrol. The two collieries and the new works when completed will give employment to several thousand men.



A view of the solvents recovery plant installed by British Carbo-Union, Ltd., in the new printing works at Watford of Odhams (Watford), Ltd. The photogravure printing process which is carried out at the works on a very large scale, depends on the employment of rapid-drying inks. These contain large proportions of common organic solvents so that their recovery is desirable economically. This plant, the first solvents recovery installation in a printing works in this country, employs activated carbon as adsorbent.

Glyceryl Esters and the Drying Oils

Recent Advances in Varnish Making

IT is increasingly apparent that the use of the drying oils in the paint and varnish industry is more and more becoming a matter of their use as components in the synthesis of much more highly developed materials, said Mr. C. W. A. Mundy in a paper on recent advances in the drying oil field, with special reference to the glyceryl esters of the drying oils, read at a meeting of the Oil and Colour Chemists' Association, in London, on December 9. In other words, the industry is fast becoming a chemical industry, utilising methods often involving a high order of technique.

An Internal Rearrangement

The annual consumption of linseed oil in the industry is estimated at roughly 40,000 tons, and of this total at least one quarter receives refining specifically in preparation for subsequent heat treatment, in the production of stand oils, varnishes and media. Of the remainder, at least half receives various other forms of treatment such as refining, oxidation, etc. In addition to this quantity of linseed oil, almost the whole quantity of tung oil used receives heat treatment, and in both cases resins are incorporated at some stage or other to impart various desirable properties.

The individual fatty acids of a vegetable oil are not present as a mixture of simple triglycerides, but as mixed esters of considerable complication. Likewise, it was well accepted that on heat treatment of two different drying oils, such as linseed and tung, an internal re-arrangement takes place between the oil molecules by a process known as ester-interchange, and the acceptance of this had largely influenced the technique of stand oil manufacture. It was probable that this process similarly went on in varnish manufacture and underlies the reason for protracted periods of maturation of the finished products. However, since the majority of the natural resins were highly acidic, esterification had to be employed at some stage or other of the process to permit of the oil to be used as a medium for basic pigments, and to confer improved properties upon the resin. Thus it had come about that instead of heat-treating the mixed oil/resin together and at the same time, the processes had become separated and combination was effected late in the sequence.

It would be obviously a much more scientific approach to the subject, said Mr. Mundy, if during the heat treatment the resin acids were caused to react with the fatty esters in such a manner as to give a mixed ester, which was neutral, and of complete stability. Such a reaction might be made to take place by the use of the mono- and di-glycerides of the drying oils resulting in the formation of a resin/oil combination of known mixed ester composition. Not a little of the oil-modified glyptal resins resulted from this basic constitution and there was no doubt that by this means the neutral resins also might be made to yield much enhanced products.

Methods of Preparation

Mr. Mundy described methods of preparation for mono- and di-glycerides, using fatty acids and glycerol as starting materials. He pointed out that tri-glycerides are a convenient starting point, economising in the amount of glycerol needed for conversion to the mono-glyceride and rendering unnecessary the preliminary preparation of fatty acids. Most, if not all, of these methods, however, are directed to the preparation of glyceryl esters to be used in the manufacture of food products. The glyceryl esters were also prepared from the tri glycerides of the drying oils. Furthermore, in connection with their specialised use in the pain and varnish industry, the drying oils may receive heat treatment. Glyceryl esters made from the fatty acids are relatively more or less unchanged compounds and that it has been established that in order to develop the inherent properties of a drying oil to the full, the oil must receive adequate heat treatment.

Glyceryl esters described in the papers were prepared by a reflux process, the pre-treated or admixture of pre-treated oils being reacted with glycerol at a temperature slightly under the boiling point of glycerol (290° C.) the process being self-catalysed. Water formed during the process is removed by maintaining a slightly reduced pressure and is conducted in an inert atmosphere. By this means pale coloured products are obtained containing a high proportion of mono-glycerides.

Discussing the properties of mono-glycerides, it was shown that mono-glycerides have a much higher viscosity than the corresponding tri-glyceride, but not as high as in cases where polymerisation has taken place. They are completely soluble in alcohol, and, therefore, their use suggests itself as plasticisers for cellulose lacquers and spirit varnishes, such as manilla and shellac. On the addition of metallic driers, soft tacky films are obtained in the case of linseed esters, but quite a tack-free yet soft film are obtained in the case of tung-linseed monoglycerides. These considerations prevent mono- and to a less degree di-glycerides from finding perhaps their full use in water paints, since they are extremely easily dispersed in water and make very stable emulsions.

Reactivity with Organic Acids

Mr. Mundy emphasised that it is due to their reactivity with organic acids that mono-glycerides are of the greatest interest. He drew special attention to the products of the reaction between mono-glycerides and the natural resins. The glyceryl esters of the drying oils are much more reactive with the natural resins than is glycerol itself, the esterification taking place in the theoretically calculated proportions as against the large excess which has to be used in most cases in esterification with glycerol itself. One of the most important properties, and one which has not been previously described, is the fact that not only do they react with resins, such as rosin, or run congo and other varnish resins, but they are solvent for for all the so-called spirit soluble resins. On heat-treatment these solutions react with the formation of new oil varnish materials of great potential interest, and from examination of a large number of resins and their reactions with mono-glycerides it is possible to differentiate between resins of two types.

Immediate in value and important as are the products of the esterification of the oil-varnish resins, of very great interest is the completely new field of investigation opened up from the fact that mono-glycerides are solvents of, and react with, the alcohol soluble resins. Shellac, said Mr. Mundy, has the greatest interest in this connection. The idea of a shellac oil varnish has for centuries attracted attention, and the use of mono-glycerides makes this readily possible, for shellac is freely soluble, including the newer hard lac resins prepared by the removal of the softer part by various means. The air-drying characteristics of the varnish are not particularly good. Water resistance is poor and the film retains a persistent tack. It is, however, very glassy and tough. This varnish readily seals wood treated with creosote, and some interesting results have been obtained by pigmentation of a medium thinned with 60 per cent. of thinners with aluminium powder. This dries very rapidly to a film free from tackiness, useful alike as a treatment prior to painting of creosoted wood and as a combined primer. Some very interesting shellac-rosin and shellac-congo mixed esters have also been made, and it is obvious that a very large field is open for exploration in this connection.

Points from the Discussion

THE CHAIRMAN (Dr. V. G. Jolly) said the author had made an excursion into quite a new field. The idea of trying to amalgamate resins with oils in a more strictly chemical manner was particularly interesting. Some time ago he had

delved into this field with the idea in mind that if the properties of varnishes, especially the better-known copal varnishes, were due to interaction between the copal acids and oils it should be possible to form mono- and tri-glycerides and bring in the copal acid molecule. He produced what was thought to be a mixed ester from the mono-glyceride of the copal acids and finished up with the linseed acid and the copal acids in the proportion they should be present in a good varnish of good oil length. It was very disappointing, however, to find that it was no better than an ordinary varnish. As a result of this, he looked more closely into the reaction between the resin acids and the tri-glycerides themselves, in the hope that as not much success had been obtained in the synthesis of this complex the reaction between the resin acids and the tri-glycerides was more complete than had been thought. It was then found that if an ordinary run copal was heated with linseed oil, fatty acid was liberated from the tri-glycerides at quite a considerable rate—probably in an hour or two—but in practice the durability seemed to be of the same order as before.

Reactions of Enzymes

Mr. Mundy, said the Chairman, had mentioned the interesting point that the reactivity of these things was extraordinarily fast, and he (the Chairman) was wondering whether this had anything to do with the fact that they did not cross-link very easily. With regard to shellac, it had been the practice in the trade for some time past to get shellac into combination with linseed oil and always one finished up with an extremely dark material.

MR. R. BHATTACHARYA asked Mr. Mundy if he had attempted the preparation of mono-glycerides from the reaction of enzymes. He himself had done a certain amount of work in this direction and had found that it was more easily possible to split up tri-glycerides in tropical countries than in this country. Nevertheless, he suggested it should be possible to get mono- and tri-glycerides by careful control of the splitting. The saponification value of glycerides was not always an indication of the mixture of mono- di- and tri-glycerides that could be obtained, and it was necessary to get a more accurate means of determining the amounts in a mixture. Referring to shellac and fatty acids, he said that the properties of shellac varnish were improved if it was made with just enough fatty acid to give 75 per cent. mono- and 25 per cent. di-glyceride. The tackiness of mono-glyceride shellac varnishes could be got rid of by adding a few extra per cent. fatty acid. In that way, a perfectly non-tacky surface could be obtained, and a number of experiments on that matter were in progress. It was very interesting to hear that other resins than congo could be esterified. With regard to colour, it was possible to produce a varnish with a pale colour provided ordinary shellac was not used but blown shellac partly polymerised.

THE AUTHOR, referring to the Chairman's remarks, said that the idea of starting this investigation was to produce mono-glycerides as a feature of the technique of the industry. This idea had been in his mind for eight years, and it was only now that he had got somewhere near to manufacturing products which approximated very closely to the true chemical entities. At the moment he had not any theory to explain certain inconsistencies in the results so far obtained, but Mr. Bhattacharya had explained how the dark colour of varnishes could be avoided, and he himself had seen some very pale ones. The colour, however, was not the fault of the mono-glycerides!

MR. P. J. GAYE said he would like to know the author's views on the side reactions in connection with glycerides, especially when considering synthetic resin formation, and also the reactions with the mono-basic and di-basic natural resin acids, because in his own view these side reactions assumed considerable proportions.

Alpha and Beta Compositions

MR. H. L. HOWARD said he would very much like to know the relative activity of the alpha and beta compositions. In reacting oil with glycerol one got a different mono-glyceride from reacting fatty acids with glycerol.

DR. J. O. CUTTER said he had been in close contact with Mr. Mundy during the development of this work, which was essentially a new branch of varnish making. With regard to the relative activity of alpha and beta, what little evidence there was indicated that they were both equivalent, although that was not the view held, say, 18 months ago. Mr. Mundy had given a means by which it was possible to reduce the water sensitivity of resins and oil compounds. It had been shown that it was possible to produce a material which possessed even higher water resistance than tung oil. On the question of di-basic acids and the introduction of linseed oil, he did not think the evidence at present showed that a di-basic acid could get into solution with linseed oil or mono- or di-glycerides without the elimination of CO_2.

Chemical and Industrial Uses of Benzole

Some Lesser Known Applications

FROM A CORRESPONDENT

OF the refined light oils produced from indigenous materials in the United Kingdom each year, benzole forms by far the largest proportion. The main outlet for benzole is as a motor fuel, and the continued growth of the automobile industry should ensure a constantly increasing demand. Much scientific research has been devoted, particularly in the past decade, to the chemistry of benzole, and a great deal has also been done to encourage its use in the motor industry. Its other industrial uses, however, have not bejen given the prominence their importance deserves, although it is true that 15 to 20 per cent. of the world's consumption is represented by industries other than the internal combustion engine.

In a paper presented at last year's Chemical Engineering Congress, W. G. Adam and G. W. Anderson, of the Gas Light and Coke Co., calculated the potential production of benzole in the different countries, on the basis of 2½ gallons of refined spirit per ton of coal carbonised, at about double the present output. There is therefore a considerable field for developing the industrial application of a product in which Great Britain is particularly rich. There is practically no limit to the industrial uses of benzole but, for the convenience of studying the principal applications, they can roughly be divided into the following groups: cellulose lacquers; leather; plactics; adhesives; polishes, paints and varnishes; paint and varnish removers; cleaning and degreasing agents; mothproofing; motor fuels; carbon removers and lubricants; rubber; waterproofing; and photography. Several uses would obviously fall into more than one group, for example, adhesives for rubber, leather and films, cleaning agents for leather, etc.

Lacquers

A whole article might well be devoted to each of the twelve groups, but these notes are intended to give no more than a general review of the possibilities. Space does not even permit of the reproduction of any of the formulæ available, but it is sufficient to say that a series of 15 typical prescriptions

for lacquers mention benzole as an essential constituent. A linoleum lacquer (hard finish), for example, contains no less than 55 per cent. by weight of benzole, and a similar lacquer with a flexible finish contains 51 per cent. The formulæ for three nitro-cellulose lacquers specify 22, 19 and 8 per cent. of benzole respectively, and three clear brass lacquers 20, 20 and 19.6 per cent. A cotton solution for the production of lacquers contains 40 per cent.; a patented lacquer black coating 35 per cent.; playing card lacquer 33 per cent.; a brushing lacquer 14.2 per cent.; a clear dipping lacquer 11 per cent.; a patented anti-fouling lacquer 8.4 per cent. and a wallpaper lacquer 8.9 per cent.

Leather and Artificial Leather

The leather and artificial leather industries are large consumers of benzole, as evidenced by the considerable number of formulæ applicable to their particular trades. One of the oldest and best known leather dressings consists of a solution of four parts of rosin in 96 parts of benzole, with a trace of aniline. Two typical leather dyes, one black and one brown, each use 80 per cent. of benzole.

A patented artificial leather base employs 500 parts of benzole in a total of 1,920 parts. In a coating lacquer for producing artificial leather on a coating machine benzole represents over 42 per cent. of the total ingredients, while several patented processes for the manufacture of artificial leather provide for the use of substantial quantities of benzole. Closely allied to the leather industry is the manufacture of shoe polishes which also absorbs a considerable quantity of benzole.

Plastics

In the plastics field there is a growing demand for benzole. It is sufficient here to refer to one of many representative formaæ. A patented plastic composition used for dental and other moulding or modelling purposes consists of 200 parts of benzole to 100 parts of eythl benzyl cellulose, three parts of triphenyl phosphate and three parts of tricresyl phosphate.

Adhesives

Adhesives in which benzole is used cover a wide range of applications, from stationery to metal and from cinematographic films to leather and rubber. A simple patented mica adhesive consists of three parts of benzole to two of gilsonite and one of rubber, and may be thinned down with benzole or raphtha. A rubber to metal cement employs 6,800 lb. of benzole to 68 lb. of crepe rubber and 40-80 lb. of bromine.

A solution of rubber in benzole is used as an adhesive for envelopes which cannot be re-sealed after having been opened. Adhesives for bonding paper to moisture-proof Cellophane, for soft and hard rubber and for rubber-to-metal joining are other spheres of usefulness for the application of benzole in quantities varying from 8 to 25 per cent. of the total constituents.

Polishes, Paints and Varnishes

Polishes, paints and varnishes provide, next to the motor and dyestuffs industries, probably the largest individual market for benzole in industry. A furniture polish that is being used by one of the largest furniture houses in America contains three parts by volume of pale lubricating oil and two parts of benzole. The benzole softens the surface, permitting the oil to leave a thin film. A representative stove polish is made with 19 per cent. benzole, 19.7 per cent. kerosene, 14.3 per cent. asphaltum, 3 per cent. lamp black and 44 per cent. Mexican graphite.

Rust-proof black paint for metals, aluminium tar paint, anti-corresive and anti-fouling paints, cellulose motor enamel, auto top dressings and paint for moderately heated metal surfaces are among the principal paint products in which benzole plays a vital part. An aluminium tar paint may be prepared by mixing 50 parts of coal tar with 20 parts of crude benzole, 20 parts of toluole, 10 parts of xylole and suitable quantities of aluminium powder.

Paint and varnish removers occupy an equally important place in the benzole market and from the heavier industrial applications the uses range down to a finger nail polish remover, containing 40 per cent. of benzole, against the 25 per cent. employed in making the polish originally applied to the nails.

Cleaning and Degreasing Agents

Cleaning and degreasing agents are among the more obvious applications and involve in general the use of higher percentages of benzole. The removal of stains is closely akin to the removal of paints and varnishes and some of the formulæ tend to overlap. Candle drippings are removed with lard and benzole; gum stains with carbon tetrachloride and benzole, and shoe polish stains with benzole alone. A useful hint in connection with degreasing refers to the removal of lubricating oil stains from concrete; benzole is mixed with a dry powder, such as hydrated lime, marble dust or whiting, to form a paste which is plastered over the stain.

The textile industry's main interest in benzole is associated with dyeing, but there are other directions in which it is well served. Mothproofing is a case in point. It is not generally known that benzole is employed as a solvent in certain proofing processes, and is thus contributing to a reduction in the total loss through moth-damaged fabrics, which, in Great Britain alone, is estimated at a million pounds annually.

Rubber

The rubber industry is dependent upon benzole for adhesives, shoe varnishes (some of which contain as much as 50 per cent. of benzole), repairing lacquers for goloshes, rubber asphalt lacquers, leather-to-rubber cements, artificial rubber latex and coloured rubber. A typical patented rubber matrix is composed of 3 lb. of commercial rubber cement, 2 lb. carbon tetrachloride, 2 lb. benzole, 4 lb. chemically pure talcum powder and ½ ounce of carbon black. Closely allied to rubber is waterproofing, another appreciable field for benzole utilisation. An effective waterproofing liquid for cloth or wood can be obtained from a mixture of paraffin, gum damar, pure rubber and benzole, to which carbon tetrachloride is added.

The photographic industry employs benzole chiefly as a constituent in film cements, of which quite a number of formulæ have been published. In one prescription it comprises 45 per cent. of the cement. In the case of safety films the percentage of benzole is slightly less, but in every case benzole is an indispensable ingredient.

Three Grades of Benzole

Benzole is produced in three grades: (a) commercial pure benzole, a high grade product also suitable for nitration and sulphonation in the production of intermediates, (b) 90's benzole, more commonly used as a solvent for various purposes, and (c) motor benzole for internal combustion engines. The three grades each have their special qualities. Pure benzole can be subdivided into two classes, commercially "pure benzole" and a still more highly refined product known as "pure benzole for nitration." The latter has a narrower distillation range and a slightly better wash test. Both are specified to be free from sulphur, determined by H_2S or SO_2 and to be non-corrosive. Both products normally distil from first drop to dry point within 2° C., this range including the boiling point of benzene, approximately 80° C.

90's benzole is a grade most commonly used for industrial purposes. The standard distillation test specifies that at least 90 per cent. by volume distils below 100° C. and at least 97 per cent. by volume befow 120° C. It should be noted, however, that the "dry point" of a straight run product is usually below 120° C. giving a maximum boiling range of about 40° C. A product of these distillation characteristics will contain 10 to 25 per cent. of toluole which is valuable because of its high solvent properties. Motor benzole, used straight or mixed with petrol is sometimes employed as a solvent, but otherwise its use is restricted to the motor industry.

Hydrogen Sulphide in Coke Oven Gas

99 Per cent Removal by a Wet Process

THE Otto Process for the wet removal of hydrogen sulphide from coke-oven gas employed at the Dutch state mines is described by Pieters (*Fuel in Science and Practice*, 1937, *16*, 327-333). The basis of the process is the following reaction which Smith and Pryde (*Gas Jour.*, 1934, 307-311) showed to be nearly quantitive: $Fe_4(Fe(CN)6)_3 + 2H_2S + 4NH_3 \rightarrow 2Fe_2Fe(CN)_6 + (NH_4)_4Fe(CN)_6 + 2S$.

In the practical application the gases, after condensation of ammoniacal liquors and water washing, are passed through towers in which they are scrubbed with a suspension of prussian blue in an ammonium salt solution containing also free ammonia, which combines with the hydrogen sulphide; the ammonium sulphide and bisulphide are then oxidised by the prussian blue to form the yellow ferrous-ferro cyanide and free sulphur, as shown in the reaction. The spent washing liquor is regenerated by aeration at 40° C., and the working losses are made up by addition of prussian blue or sodium ferrocyanide and ferrous sulphate (before aeration). The sulphur is floated and is recovered from the foam. By adjusting the concentration of the iron complex in the washing liquor, the sulphur can be obtained almost completely as ammonium thiosulphate. By this process, 99 per cent. of the H_2S in the gas can be removed and recovered, if the volume of the wash liquor is about 1 per cent. of the volume of gas treated.

The ferrocyanide required can be obtained from the hydrogen cyanide contained in the original distillation gases, which is condensed with the ammoniacal liquors. These liquors are distilled, yielding hydrogen cyanide, ammonia, hydrogen sulphide, and carbon dioxide, which are passed into a caustic soda or soda ash solution, in the presence of free iron, or of a dissolved ferrous salt. In this way, sodium ferrocyanide is formed practically quantitatively.

Scotland's First Trading Estate

Forty Factories in Course of Erection at Hillington

AT the Hillington Trading Estate, near Glasgow, forty factories are now in various stages of erection on what was until six months ago, a stretch of agricultural land. This is the youngest estate to be established under the auspices of the Commissioner for the Special Areas, and is four miles from Glasgow and less than half-a-mile from the George V Dock, built in 1930. It adjoins the Renfrew airport, from which there is a daily service to Croydon. The estate consists of 320 acres and is thus about the same size as the Treforest estate in South Wales. Standard factories of 5,000 square feet are being built in blocks of three or four, thus enabling a tenant to expand his premises as business grows.

A representative of THE CHEMICAL AGE, who visited Hillington a few days ago, was greatly impressed with the progress of the estate, which, to judge from the achievement of the first six months, is soon likely to rival the older estates near Newcastle and Cardiff. The attractions of all these estates include financial assistance from the Special Areas Reconstruction Association, while the Commissioner is now empowered to assist with rent, rates, and income tax in the case of new or struggling firms.

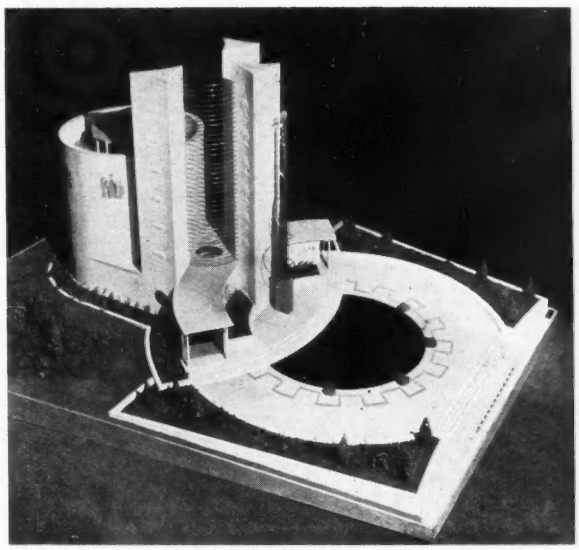
A novel feature at Hillington is the provision of "nest" factories, built in blocks of seven or eight, covering 1,200 square feet to let at £50 per annum. This rent includes heating, which will be supplied from a central boiler house, while a sub-station for electric power will be erected shortly.

Two factories are already occupied, and among the firms which have made reservations at Hillington are Aeroxfilters, Ltd. (filters), Scottish Alloys, Ltd. (alloys and die-casting), Saturn Oxygen Co., Ltd. (manufacture of oxygen), Sunshine Bleach, Ltd. (bleaching fluids).

Empire Exhibition, Glasgow

I.C.I. Pavilion Nearing Completion

THE first private building to be erected in Bellahouston Park for the Empire Exhibition is the I.C.I. Pavilion, now nearing completion. This pavilion has been designed by Mr. Basil Spence, of Edinburgh, who is also responsible for other exhibition buildings, such as the North and South Scottish Pavilions.



Model of the I.C.I. pavilion showing the ornamented pool, the rotunda, and the three symbolic pylons. A fountain is to be installed in front of the rotunda and the whole building will be floodlit at night.

The main feature of the design is a group of three pylons which symbolise air, earth and water, the raw materials of the chemical industry. These pylons are connected with bars of bright non-ferrous metal, and in front of them is a central shaft filled up of non-ferrous metal tubes to indicate I.C.I.'s connection with the non-ferrous metal industry. The pavilion has been entirely built with I.C.I. products (with the exception of eight steel girders and the woodwork) in order to demonstrate the suitability of synthetic materials and fabrics in modern architectural and descriptive schemes.

Production of Pure Benzyl Chloride

Direct Chlorination of Toluene

A SMALL scale plant for the efficient production of pure benzyl chloride from toluene by direct chlorination is described by Bianchini (*Ann. Chim. Appl.*, 1937, *27*, 422-426). Gaseous chlorine is led into toluene contained in a vessel immersed in a steam heated mineral oil bath. The temperature is so adjusted that the reaction takes place in the vapour phase; the hydrogen chloride resulting from the interaction passes up a vertical condenser in which any of the reactant or product are condensed and drops back into the reaction vessel, while the acid gas is cooled in a worm and is then absorbed in water to form 20° Bé acid, a valuable by-product.

When operating on 50 kg. charges, of toluene, practically complete conversion can be obtained in 24 hours. The benzyl chloride is syphoned out of the reaction vessel, into a tank, where it is thoroughly washed by agitation with water, and is further purified, if necessary, by distillation. The product thus obtained is substantially pure, as is shown by its chlorine content (25-26 per cent.), and is of constant physical properties from batch to batch.

Hydrogenation Applied to Coals and Tars

An Outline of Present-day Practice

HYDROGENATION, with special reference to the products obtainable, was the subject of a lecture which Dr. F. A. Williams, M.Sc., A.I.C., of the Fuel Research Station, Greenwich, recently delivered to the Hull Chemical and Engineering Society.

The term hydrogenation, said Dr. Williams, originally applied to reactions involving only addition of hydrogen to unsaturated compounds as in fat hardening, is now used to include many complex reactions taking place under pressures of the order of 200 atm., and at temperatures of 400-500° C. Diverse materials, such as petroleum, tars and brown and black coals, are now treated. The process is of interest as providing one means of obtaining a high yield of oils or motor spirits from coal; in addition, owing to the ease with which low temperature tars lend themselves to the treatment, hydrogenation assists the process of low temperature carbonisation by offering a good market for the tar.

The substitution for petroleum products of synthetic materials has proceeded most extensively in Germany where, in 1935, 44 per cent. of the country's consumption of motor spirit was home produced and about one-third of this figure was the result of hydrogenation.

Description of the Process

The coal is first subjected to hydrogenation in the liquid phase. The ground coal is first made into a paste with an equal weight of oil obtained from the process itself. A small proportion of catalyst—a compound of tin—is also incorporated, the amount being less than 0.1 per cent. of the coal. In an experimental plant at the Fuel Research Station, this paste is injected into the converter at a pressure of 200-250 atm. together with hydrogen. The converter can be maintained at any temperature in the range of 420-460° C. by means of an electric furnace. In large scale practice, the converters are not heated directly. The ingoing paste and hydrogen pass through preheaters and the converters are lagged. Two products are obtained. One is the sludge which overflows from the converters and which consists of coal ash, catalyst, unconverted coal and heavy oil, the latter being recovered. The other product consists of oil volatile in the stream of hydrogen; this oil is fractionated into spirit boiling below 200° C., middle oil boiling from 200° to 310° C., and heavy oil boiling about 310° C. This heavy oil and the heavy oil recovered from the sludge are used to make further batches of paste with fresh coal. The spirit after refining by treatment with acid and alkali is suitable for use as motor spirit. The middle oil goes forward to the next state, the vapour phase state.

Strict Temperature Control

The middle oil is vapourised and passed together with hydrogen under pressure over a fixed catalyst consisting usually of molybdenum and tungsten compounds. A large proportion of the product consists of spirit distilling up to 200° C. The higher boiling oil is simply recycled. In a semi-technical plant at the Fuel Research Station, which treats 300 gallons of tar or oil per day, the ingoing oil and hydrogen are preheated and the reaction vessel is not directly heated. The reactions are markedly exothermic and require very strict temperature control.

By the use of suitable conditions in the liquid phase state it is possible to arrange that no excess of heavy oil is obtained above that required for making the paste with coal. As practised on a large scale a proportion of low-temperature tar is used for making paste with the coal. Excess of heavy oil is therefore obtained and necessitates the use of a second liquid phase stage to break down this heavy oil to middle oil.

In general, the lower the carbon content of the coal, the more easy it is to hydrogenate, other factors being similar. Thus brown coals are more easy to treat than black coals. Black coals containing up to about 86 per cent. carbon can be worked using the normal pressures (200-250 atm.), but coals with higher carbon require higher pressures. Low ash content is needed, because the alkaline nature of most coal ashes is deleterious. As far as treatment of tars and oils in vapour phase is concerned, the atomic hydrogen to carbon ratios (where the hydrogen is the disposable hydrogen only) affords an indication of the ease with which hydrogenation can be effected. The higher the ratio the greater the ease.

Chemistry of the Process

The process possesses great flexibility and as a result a variety of products can be obtained. The research involved in their production has been largely empirical up to the present, because of the complex natures of the materials treated. Coal possesses colloidal properties. Chemically it appears to consist largely of a honeycomb structure of six-membered carbon rings. During hydrogenation the oil present assists in breaking up or dispersing the coal particles. Deoxygenation and removal of sulphur and nitrogen proceed in the liquid phase state and this process is completed in the vapour phase, only traces of sulphur remaining in the final spirit.

It is possible to illustrate the type of reactions taking place in the vapour phase state by reference to the study of the behaviour of pure compounds in progress at the Fuel Research Station. It has been found that there are three main types of reaction:—(1) Deoxygenation, (2) hydrogenation, followed by cracking, and (3) cracking. The behaviour of phenol may be taken as an example of type (1). Phenol under hydrogen pressure is stable up to hydrogenation temperatures in the absence of catalusts. In the presence of an active catalyst, *e.g.*, a molybdenum compound, benzene is the principal product together with cyclohexane and a small proportion of condensed compounds. The last-named are not obtained in the presence of the most active catalysts. With more complex phenols the tendency to the formation of condensed compounds is more pronounced and hence very active catalysts are required to prevent this.

The second type of reaction may be illustrated with reference to naphthalene which is again stable under hydrogenation conditions and in the absence of catalysts. In the presence of catalysts, tetrahydro-naphthalene is the principal primary product and this undergoes cracking (ring rupture) and saturation of the unsaturated atoms formed, giving butyl benzene. Other condensed nuclear hydrocarbons behave similarly.

The third type of reaction cannot be illustrated easily. Carbon-to-carbon linkages are broken as a result of thermal treatment. Certain catalysts, among them molybdenum compounds, assist the cracking. Once cracking has occurred, the unsaturated molecules can polymerise unless hydrogenation proceeds sufficiently rapidly to saturate the fragments. High speed of hydrogenation is therefore essential to prevent polymerisation and, ultimately, coke formation.

Yield of Final Products

The production of spirit distilling up to 200° C. may be as high as 60 per cent. of the dry ash-free coal processed or about 165 gallons per ton of dry ash-free coal. The spirit, however, is deficient in the low boiling constituents, although of satisfactory octane number. To improve the volatility, lower yields are inevitable owing to the formation of gas. High active vapour phase catalysts have been developed to assist, and spirits of high volatility and high octane number have been successfully produced. Such a spirit may be obtained in a yield of 140 gallons per ton of dry ash-free coal. Attempts to produce a fuel suitable for the modern high-speed diesel engine are meeting with some success.

Organisation in Paint and Colour Works

Estimating the Cost of Manufacturing Operations—Control of Stock and Production

ASPECTS of paint works organisation and costs were reviewed by Mr. T. Raines, of Lewis Bergner and Sons, Ltd., in an address to the Manchester section of the Oil and Colour Chemists' Association on December 10. He dealt with the subject under the headings of budgeting for manufacturing operations, planning and stock control, and production control.

Giving a detailed analysis of charges, Mr. Raines said raw material cost comprised actual cost of raw materials, plus cost of purchasing, cost of stores department, loss in handling and storage. The machine hourly rate was made up of power charges, maintenance of machinery, maintenance of buildings, plant depreciation, interest on capital invested, heating, lighting, rent, rates and insurance. Direct labour charges comprised labour for mixing, labour for grinding, labour for thinning, labour for filling, labour for handling to warehouse. Indirect labour charges were represented by wages for departmental manager, wages for foremen, wages for shop cleaning, etc. The items which comprised administrative overheads were salaries and expenses of chemical laboratories and salaries and expenses of development department, works office, welfare department, etc. Package costs embraced container cost, packing cost, cost of warehousing, cost of labelling and colour spotting, and factory transport. Cost of selling was represented by travellers' salaries and expenses, general office and accounting charges, advertising expenses, outward freight, reserve for bad debts, discount, etc. The totals of all these entries plus profit represented selling price.

Working in Unison

Mr. Raines said it was impossible to give a set lay-out for the organisation of large and small firms; each had its own peculiarities. Before embarking on any scheme of paint works organisation it was necessary to ascertain a few very important facts. First of all, there was the product and the quantity to be made. Then there was the need to plan production—getting materials in and out of the works. The third item to be considered was the method of doing it. The expert's job was to get these factors working in unison.

As the paint trade was not subject to violent fluctuations, owing to fashions and new markets, most firms found it a reasonably simple job to prepare a costs budget. The paint trade ran on a fairly even keel and was subject only to boom years and depression years. Ordinarily it was quite easy to get statistics of past sales. Although these might be obtained from the sales department itself, this was not a factory department and as a result their returns must be converted back to weight or volume. Detailed month by month sales over a number of years would enable one to calculate, with a fair degree of accuracy, the sum total of the amount of goods the manufacturer would need to produce in the next six or twelve months. Any increase or decrease in sales was usually fairly gradual, so that in standard lines one could safely prophesy the approximate quantities that would have to be made.

Economy in Production

"If you arrive at the amount of goods you are likely to require for the ensuing six or twelve months, you are in a position of being able to contract for your supplies," continued Mr. Raines. "This gives your purchasing department fair time to look around, find the best market and place contracts in much more favourable conditions than buying on short term notice. There is nothing worse than springing a sudden demand upon the purchasing agent whose temper is apt to get frayed and you do not get the goods at the price you need. The prosperity of your firm depends upon economic purchasing as well as on economy in manufacture."

The quantity of goods to be manufactured would be determined by the directors as part of the general policy of the company. Some firms liked to have a liquid balance sheet with small stocks, but showing plenty of liquid assets, often cash assets and investments, whereas others set out to have big stocks ready to meet any demand. If it was possible to calculate forward with fair accuracy the quantity of production and the consumption of raw materials, one could also budget for labour and so make a greater spread of labour over the whole of the year. "I am not going to say it is unprofitable to work overtime," declared Mr. Raines. "It would take a long time to make out the case for or against overtime, although it was true that by the overtime system one could make more use of the buildings and also obtain a better advantage from the amount paid in rates and taxes. The advantage of being able to calculate the labour strength required in advance was that the manufacturer was able to keep the flow of work quite regular, which was better than in times of pressure making application for labour to the labour exchange." Expenses could also be budgeted.

In the factory they were not concerned with taking orders from the sales department; what interested them was the time those orders came forward. The factory wanted its orders as quick as it could get them. In many London districts the mail arrived at 8 a.m., but by paying about £3 10s. a quarter firms could collect their letters at 7 a.m. That meant the works department got its orders one hour earlier. How to deal with the incoming orders depended upon the type of business conducted. Amongst the requisitions would be some which could be delivered from stock and others which would have to be specially manufactured. For the lines which were in stock, nothing more had to be done than take a copy of the order from the sales department to the warehouse. Some paint firms passed all orders to the warehouse department which then gave instructions as to the goods which they required to be made. That was at one time the normal practice; the quicker way was to give the order to the planning department or works office who would issue the manufacturing instructions in the form of a production order to the department concerned.

Works Office Routine

Orders came in in all degrees of weight and measure and if these were dealt with first of all by a clerical department, equipped with calculating machines, they could find from standard formula of those goods the exact quantities required for the batch for the customer. After the order came into the works office, instructions were made out as to the fillers, mixing, thinning and types of packages to be used, etc. Hence the manufacturing department was in a position to deal with the order and to make preparations for it to be quickly fulfilled. When issuing the instructions for manufacture, a slip should be sent to the warehouse preparing them to receive the goods from the manufacturing department. When the paint was finally mixed, ground and perhaps thinned, there was the necessity for testing.

In the planning operations there was need of a system of stock control. Some firms kept all their data in books; this was a method that entailed the expenditure of much labour. Others used a card system, the card giving particuars of stock maximum and stock minimum. When it was observed the stock had dropped to the minimum which might be 100 gallons (against 300 gallons maximum) steps were taken to effect replenishments. One of the cheapest methods—though it might not sound very economical—was to have cards representing cans of paint. Paint went out in 5, 10 and 20 gallon lots. Stock in a particular time could be represented in units of 5, 10 and 20 gallons, by cards, which could be added to or taken

away according to the variations in quantity. This was a quick method of ascertaining exactly what was in stock at any time. If the manufacturer had the punch card coining system he was well off. Each was a quicker and better method of stock control than debit and credit entries in a book. With punch card accounting one girl could control the stocks, including raw materials.

Markets which two or three months ago reached their peak, were now beginning to flatten out. This had influenced many consumers of materials to buy hand to mouth, rather than contract forward. The result was that managements were not so keen on replacing goods at to-day's market prices, if they could avoid doing so. When a position like that arose, the paint manufacturer had to consider whether his normal minimum stock was stated at a figure too high having regard to the circumstances. If the management knew how far they could safely go below the normal minimum, they might be able to save the firm quite a lot of money by waiting for the further drop in raw materials. Many firms considered three or four months supplies to be a normal stock. No one could safely say how far any firm should go below a normal stock figure. When markets were falling there was no reason why the manufacturer should not go down to one month's stock so long as the plant was capable of providing the customers requirements quickly.

"To recommend the issue of all raw materials from a separate store was text-book practice," said Mr. Raines. Having seen one or two firms that operated that system very stringently, he could only say that the cost of doing the job that way was very high; there was also delay in the issue of materials. In the manufacturing department there might be a secondary store department, served from the main store. This secondary store issued materials carefully weighed to the mixer who was assured of receiving just the right quantity of material he required, neither more nor less.

Selection of Labour

In labour control, the first thing of importance was to select the right kind of personnel. It definitely paid large employers to have one man—one man only—to select the labour for all sections of the works. If this was left to the average departmental manager, the results would not be as good as when left to a man experienced and skilled in interviewing and engaging men. There was a lot to be said for and against wage incentives. An initial difficulty was the objection of the workers themselves. When it was first indicated to them that if they produced more than a certain amount they would get a bonus, the feeling immediately crept in "What is the governor getting out of this?" Naturally the governor would get something out of it as he set the standard by which he would judge the success or failure of his men. "In the paint trade I have been told by experts that we are lucky if we get anything like 75 per cent. efficiency of what a man can reasonably do," declared Mr. Raines. He had knowledge of one scheme which when it was introduced, caused the employees to become agitated and nervous. Results in such circumstances could not be satisfactory. If one examined American statistics, it would be found that 50 per cent. of the firms who had paid a wage incentive on certain lines had cut it out. They had either reverted to day-time or piece-work.

It was important that there should be a medical examination of employees before utilising their services, especially as some persons were very susceptible to lead poisoning or to the effects of solvents used in lacquer manufacture. The works doctor would certainly take a look at the man's teeth, which if decayed might hold deleterious matter. A man with bad teeth was much more liable to sickness than a man with good teeth.

"Put in the best machinery that money can buy and drive it in the best manner possible," advised Mr. Raines. If paint manufacturers put down good plant and a good motor they could forget maintenance for a long time. Be certain each repair is a really good job. Every patch you put on a piece of machinery means loss of production. In expenses control it was a mistake to try to save money by beating down the maintenance engineer to his lowest figure. Maintenance of plant was not expensive if it enabled the manufacturer to get the fullest production possible. In the paint trade it was not possible to say to the department manager "Your production will be 500 tons of paint; we shall, on that basis, allow you so many pounds to spend on plant maintenance in the year." It was difficult to allot any set amount for the purpose.

In regard to the lighting of paint factories, Mr. Raines said much good work had been done by the suppliers of apparatus, rather than by the users of the lights. If the establishment was not illuminated as efficiently as it ought to be, the best thing was to go to the apparatus manufacturer. The man who was running a paint works could not be an expert in lighting as well. Until one had the benefit of the services of a lighting expert, one did not realise how much more light one could get for less money. High frequency lighting, which emitted a green shade of illumination, although generally good, was hopeless for the paint works because it caused remarkable distortion.

Packing, Storage and Delivery

Packing, storage and delivery and works reports were also discussed. What the paint manufacturer wanted to know was what production he had got for his expenditure on labour, plant and materials. To be able to judge that, he had to take the basis of judging the value of his production against the value of his labour and other costs. The figure could be taken from cost records or from timed operations. The best method known so far was standard costs which were easily applied so long as the paint manufacturer was making standard products, but if he had a large variety of special lines, the amount of clerical work involved was rather colossal. If a firm was turning out 90 per cent. standard goods in a year, there was no doubt it was best to use standard costs. If the percentage was 50 per cent. standard goods and 50 per cent. specialised lines there would be difficulty in operating on standard costs. For specialised lines the manufacturer had to arrive at an average cost per unit of manufacture of each of his products. By dividing the number of units into the cash value of labour and expenses, he was given a valuable guide to detailed costsings, and to the efficient operation of the factory.

Cost accounting was spending and making sure you get back that expenditure in due proportion over the articles on which the labour and materials have been utilised. It was no use just saying that a paste paint department had cost a certain sum for an output of 20 tons, because if the department had been grinding white lead at one end of the shop and French ochre at the other, it would be found that French ochre cost was about five times as much as the white lead. There must be charged to the job exactly what had been expended upon it. Materials should be charged at cost, plus the cost of purchasing and handing them on to the department. A percentage might be added to the raw materials cost to cover handling and other incidental expenses. This might be anything from one-half to two per cent. of the value of the goods; costs varied considerably.

Non-Productive Jobs

Production labour had to be booked from the commencement to the end of the job. Whether one should book waiting time or idle machine time was a matter for each individual firm to decide in its own way. If a workman was looking after roller mills, and in some cases he could look after as many as nine machines, that was a different proposition from waiting time. But whether the manufacturer booked waiting time or not, he definitely had to allot it to a productive or non-productive job. The same result was achieved in the long run. If every production order was given a job number there was little difficulty in correctly charging labour to the job. Unproductive labour was fairly constant year by year and it could be expressed as a definite percentage to productive labour.

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In its report for the 1936 trading year the Bauxit-Trust A.G., of Zurich, discloses a net profit of 1½ million francs as against 800,000 francs in the previous year. The trust exercises control over bauxite producers in Hungary, Jugoslavia, Czechoslovakia and Roumania.

Personal Notes

SIR CHARLES CRAVEN, O.B.E., chairman of the English Steel Corporation, Ltd., has been re-elected chairman of the Industrial Welfare Society.

DR. E. GREGORY has resigned from the post of lecturer in metallurgy at Sheffield University; MR. DONALD HAVENHAND has been appointed assistant lecturer in metallurgy.

MR. EDWARD HARRY SIMMONS, of The Dell, Egerton Park, Worsley, vice-president of the Pharmaceutical Society of Great Britain, has left estate valued £32,078, with net personalty £29,983.

MR. CHARLES FREDERICK HUFFAM, of Winmara, Ladybrook Road, Cheadle Hulme, a former director and chairman of Joseph Crosfield and Sons, Ltd., soap manufacturers, has left estate valued at £34,290, with net personalty £30,577.

MR. G. COPPING has become joint editor and general secretary of the Oil and Colour Chemists' Association. MR. A. J. GIBSON has been carrying out the current duties of general secretary since Mr. Aitken retired at the end of October last.

DR. A. E. DUNSTAN, of the Anglo-Iranian Oil Co., Ltd., has been appointed external examiner in fuel technology and mining chemistry at Sheffield University; DR. C. J. PEDDLE, F.I.C., has been appointed external examiner in glass technology.

MR. JOSEPH WAINWRIGHT, of Caldy, Cheshire, works manager for Lever Brothers, Ltd., Port Sunlight, has been appointed a magistrate for Cheshire. He was a member of Bebington Council for ten years from 1903, and was chairman in 1910.

SIR JOHN CARGILL, of Glasgow, chairman of the Burmah Oil Co. and of Scottish Oils, Ltd., and director of the Anglo-Iranian Oil Co. and allied concerns, who has been seriously ill for several months, has made a complete recovery. He has resumed business duties, and is planning to go on a tour of the various undertakings early in 1938.

LADY MUSPRATT has presented the newly-established Widnes branch of Toc H with a Rudolph Muspratt lamp, in memory of the late Mr. Rudolph Muspratt, only son and heir of the late Sir Max Muspratt, Bart., who was a director of Imperial Chemical Industries, Ltd. The lamp was lighted by Lord Halifax at the 22nd annual birthday festival of Toc H, at York, on December 11. Mr. Rudolph Muspratt died in January, 1929, at the age of 24.

SIR LEONARD LYLE, Bart., has retired from the chairmanship of Tate and Lyle, Ltd., sugar refiners. He played a leading part in all the negotiations that took place between the United Kingdom Sugar Industry Committee, the Ministry of Agriculture and the Treasury, preceding the amalgamation of the beet sugar companies into the British Sugar Corporation, Ltd. He has been chairman of Tate and Lyle, Ltd., for a period of fifteen years, and has now become president.

OBITUARY

MR. FRANCIS HARVEY, chairman of Shearer and Harvey, Ltd., candle manufacturers, Ibrox, Glasgow, died on December 12 in his 82nd year.

MR. JOHN MOORE, of Ingram Bros (Glasgow), Ltd., syrup refiners, was one of the victims of the railway disaster at Castlecary on December 10.

MR. SAMUEL CUTLER, a director of Dry Gasholders, Ltd., and of C. and W. Walker, Ltd., makers of by-product recovery plant, died on December 7, in his 69th year.

ALDERMAN HENRY ASTLEY-BELL, a prominent figure in the Lancashire cotton industry for 40 years, has died at the age of 67. He served on the general executive of the Manchester Cotton Employers' Association, on the executive of the British Cotton Growing Association, and on the Empire Cotton Committee. He was also chairman of the Preston Gas Co., and president of the Preston Chamber of Commerce.

MR. SAMUEL PITT, head of Samuel Pitt and Co., chemical and fertiliser brokers, Bath Street, Glasgow, has died at the age of 85. Mr. Pitt started in Glasgow with a firm of nitrate importers in 1870 and commenced business on his own account in 1887. For the last 20 years of his life he was almost blind, but continued to attend to business.

MR. T. MEREDITH EVANS managing director of the Beaufort Tinplate Co., Ltd., and a well-known figure in the Welsh steel and tinplate industry, died suddenly at his home at Swansea on December 11. He had been on the committee of management of the Swansea Metal Exchange since 1928, and was a member for many years of the Welsh Plate and Sheet Manufacturers' Association.

DR. ARTHUR HUTCHINSON, emeritus professor of mineralogy and formerly master of Pembroke College, died at Cambridge on December 12, aged 71. Dr. Hutchinson was professor of mineralogy at Cambridge from 1926 to 1931, and was a past-president of the Mineralogical Society. He was educated at Clifton College, and won a scholarship to Christ's College, Cambridge, graduating in 1888 with a first class in both parts of the Natural Sciences Tripos. He studied in Germany at Munich and Wurzburg, taking his Ph.D. at the latter University, and carrying out research under Emil Fischer on the reduction of aromatic amides.

Foreign Chemical Notes

Holland

THE N.V. INTERNATIONALE VISCOSE COMPAGNIE, of Breda, reports a loss of 3,088 florins in the 1936-37 trading year.

Lettland

FERTILISERS AND IODINE are to be produced from seaweed at a factory contemplated by the Ministry of Agriculture.

Czechoslovakia

PRODUCTION OF BEECHWOOD CELLULOSE has been embarked upon by several smaller manufacturers, including the Kubik concern of Prague.

Denmark

THE ERECTION OF A RAYON WORKS is planned by a Swiss financial group, headed by the Soc. Financiere pour l'Industrie de la Soie Artificielle, of Geneva.

France

BARIUM SULPHATE DEPOSITS at Aveyron are to be worked by the Société des Couleurs Zinciques, who propose to erect plant for grinding and refining the mineral.

Germany

FOLLOWING THE LIQUIDATION of the Strassfurt Chemical Works, arrangements have been made for the assets to be taken over by the Preussag concern.

DEPOTS FOR THE EXTRACTION OF GRAPE SEED OIL in the vine-growing districts are to be established. The oil is of good edible quality and will shortly appear on the market.

Hungary

A FACTORY FOR MAKING RUM AND LIQUEUR ESSENCES has been erected in Budapest by Fantl and Pick G.m.b.H., of Vienna.

A NEW PHOTOGRAPHIC CONCERN, the Rex Film Co., has been formed in collaboration with an Italian group (The Tensi Co.).

THE PRODUCTION AND REFINING OF WOOL FAT is to be carried on by Gerö and Dr. Ofner, who hope to cover about one-half of the home requirements in refined wool fat.

A NEW ENTERPRISE FOR PRODUCING COSMETICS and pharmaceutical preparations, on the basis of Hungarian vegetable oils, has been formed under the style of Neovasol Chemical Industry Co., at Budapest.

From Week to Week

THE 1938 EDITION of THE CHEMICAL AGE Year Book will shortly be published. It is free to all direct subscribers to THE CHEMICAL AGE registered before January 1, 1938. Non-subscribers, desirous of receiving a copy of the book, should register as soon as possible. A subscription form will be found on page 504.

A WIDESPREAD REPORT THAT OIL HAD BEEN STRUCK in quantity during the drilling operations at Midlothian, Scotland, is not supported by official statements.

NEGOTIATIONS HAVE BEEN STARTED with a view to reconstituting the International Zinc Cartel. It is expected that they will be long and difficult, as certain producers oppose the restriction of production.

THE NEW ZEALAND PETROLEUM BILL, vesting in the Crown the ownership of all petroleum existing in the natural state in New Zealand, has been passed by the House of Representatives, at Wellington.

THREE STEEL CYLINDERS containing a highly-explosive gas, were missing at the Royal Albert Dock, North Woolwich, London, on December 9. The cylinders contained cyclopropane gas, and it is believed that they were stolen.

HENRY WIGGIN AND CO., LTD., have concluded arrangements with the H. A. Wilson Co., of Newark, New Jersey, for the manufacture of a complete range of "Thermometal" at Birmingham. A leaflet setting out the properties of these materials has been issued.

THE PRICE OF CEMENT is to be increased by 3s. per ton in England, Scotland and Wales. The Cement Makers' Federation state that the increase is due to the rise in the cost of coal and other items, and the higher wages recently agreed by the National Joint Industrial Council.

THE EAST ANGLIAN SECTION of the Institute of Chemistry discussed industrial nitrocellulose and its applications at a recent meeting held at Norwich. Dr. J. S. Gourlay, of Nobel Chemical Finishes, Ltd., dealt with the subject historically and related how the manufacture of nitrocellulose lacquers had succeeded the manufacture of guncotton at Stowmarket.

CALEDON DARK BROWN 4RBS (patented), in addition to the I.C.I. range of Caledon dyestuffs, is easily reduced to a soluble leuco compound possessing very good affinity for vegetable fibres. It is capable of being applied in circulating machines, on the jig or in open dyebecks and is particularly suitable for the production of heavy chocolate browns on cotton, viscose and linen. It is suitable for the dyeing of silk for the production of fast boiling shades.

BRITISH STEEL PRODUCTION during November reached a total of 1,178,300 tons. This is the highest monthly rate ever achieved by the industry. Compared with the previous record of 1,163,000 tons in September, it also represents the largest daily rate of production. In November, 1936, the output was 1,001,300 tons. The production of pig-iron in November amounted to 762,300 tons, compared with 769,600 tons in October, and 643,100 tons in November, 1936. There were 135 furnaces in blast at the end of November compared with 133 furnaces at the end of October.

THE SOCIETY OF GLASS TECHNOLOGY announce that Professor W. E. S. Turner's presidential address to the society on the occasion of its 21st anniversary meeting in Sheffield, November 9, 1937, has been printed and issued in book form, entitled "Twenty-one Years—A Professor Looks Out on the Glass Industry." The address contains much matter never previously available concerning world-wide developments of the glass industry and should be a mine of information alike for executive officers, technologists and social workers interested in the industry. The price is 10s. post free, and the proceeds are to be devoted to the Society's "Elmfield" Fund. A limited number of copies bearing Professor Turner's autograph are available at £1 per copy. Orders should be addressed to the Secretary, Society of Glass Technology, Darnall Road, Sheffield, 9.

THE FIRST ISSUE of *Ambix*, the journal of the Society for the Study of Alchemy and Early Chemistry, contains an introductory article on "The Study of Alchemy," by Sir Robert Mond. Among other contributions are Part I of "A Bibliography of Alchemy" (Gerard Heym), "Albertus Magnus on Alchemy" (J. R. Partington), "The Origins of Greek Alchemy" (F. Sherwood Taylor), a report of a discussion upon chemical and alchemical symbolism, and book reviews. *Ambix*, published quarterly, is edited by Dr. F. Sherwood Taylor, 8 Bream's Buildings, Chancery Lane, London, E.C.4. The Society, of which Sir Robert Mond is president, was formed to further the scientific and historical study of alchemy, and meetings are held for the reading of papers and for discussions. Members of the Society (annual subscription 21s.) receive *Ambix* free of charge; to non-members, libraries and institutions the cost of the journal is 24s. per year.

THE INSTITUTE OF CHEMISTRY has just published the 9th edition of "A List of Official Chemical Appointments."

THE CHEMICAL SOCIETY'S LIBRARY will be closed for the Xmas holidays from Thursday, December 23, at 1 p.m., until Wednesday, December 29, at 10 a.m.

THE OCEAN CHEMICAL CO., LTD., Lower Nuttall, Ramsbottom, Lancashire, held its third annual dinner and concert on December 4 at the Old Dun Horse Hotel, Ramsbottom. MR. C. Goffey presided.

WITH THE OBJECT OF ILLUSTRATING THE SALIENT PROPERTIES of "Gryps" brand fertiliser steamed bone flour, British Glues and Chemicals, Ltd., have issued a booklet entitled "The Phosphate Question."

THE ANTIGUA SUGAR FACTORY, LTD., had had an astonishingly large crop of sugar—an increase of 10,000 tons, or 50 per cent., over last year and over the average of the last five years, said Mr. G. M. Stuart, presiding at the annual meeting last week.

AUXILIARY PRODUCTS FOR THE TEXTILE TRADE, for the prevention of faulty results and the improvement of the quality of the material, are the subject of a supplement to the current issue of "Ciba Review," issued by The Society of Chemical Industry in Basle.

GREASEPROOF PAPER PRODUCERS belonging to the so-called Scangreaseproof Convention, at Stockholm, have prolonged the agreement for three years. The present prices are to be maintained for the time being. Some reduction in output will be made from January 1, 1938.

THE BRITISH SUGAR CORPORATION'S FACTORY at Cupar completed its 1937 season on Saturday last after a run of 46 days during which more than 8,500 tons of white granulated sugar and 5,000 to 6,000 tons of mollassed boot pulp were produced from 60,000 tons of beet.

THE SOCIETY OF CHEMICAL INDUSTRY and the Birmingham University Chemical Society, held a joint meeting at the University, Edgbaston, Birmingham, on December 8, when Dr. C. H. Johnson gave an address on "The Application of Radio-Active Elements to Chemical Problems."

THE BIBLIOGRAPHY OF LITERATURE ON AGRICULTURE and allied subjects prepared by the Central Agricultural and Scientific Bibliography in collaboration with the Bureau of Chemical Abstracts and the Science Library will complete its first volume with the number for January, 1938. This bibliography is issued quarterly; the subscription price is 15s. per year.

THE PART PLAYED BY THE BRITISH INDUSTRIES FAIR in Empire trade will be the subject of a broadcast talk by Lord Derby to all Empire countries, the United States, South America, and the Near East, between January 18 and 25. Lord Derby is president of the British Textiles Exhibition Committee, which is responsible, in co-operation with the Department of Overseas Trade, for the organisation of the textiles section of the Fair.

THE 4TH INTERNATIONAL CONFERENCE ON TIMBER UTILISATION to be held in Vienna, July, 1938, will include a congress on the chemistry of wood, the preparatory work for which has already been taken in hand by Professor Mark, with the support of the Austrian Federal Government. Papers to be read will include "The Chemistry of Cellulose" (Professor W. N. Haworth, of Birmingham), "The Chemistry of Lignin" (Professor K. Freudenburg, of Heidelberg), "The Chemistry of Resins and Terebenes" (Professor Vanzetti, of Catania) and "Methods of Disintegrating Wood" (Professor E. Hägglund, of Stockholm).

THE IMPERIAL INSTITUTE'S "Statistical Summary of the Mineral Industry of the British Empire and Foreign Countries, 1934-36" has been issued. This volume gives statistics of the production, imports and exports of 48 minerals and metals recorded in previous years, in addition to which such statistics as are available have been added for tantalite, selenium, tellurium and zirconium minerals. The tables refer not only to the crude materials, but also to the chief semi-manufactured products and in some cases the principal chemicals and derivatives. Copies may be obtained from the Imperial Institute, South Kensington, London, S.W.7, price 7s. 6d. (8s. post free).

FOR THE CONVEYANCE OF LIQUID CHEMICALS IN BULK, Imperial Chemical Industries, Ltd., and the London and North-Eastern Railway Co. have jointly introduced a new road-rail unit. The new unit was used for the first time last week, on trains running between Billingham and London. The unit takes the form of de-mountable tanks, made in various metals to suit the nature of the chemicals which are being conveyed, with a special six-wheeled chassis having auxiliary springing and the necessary brake gear to enable it to run on an express goods train. Where desirable the liquid charge can be kept at a specified temperature by insulation, steam heating or electrical heating throughout the journey, in order that it will be a proper fluid condition to facilitate discharge when it arrives at its destination.

SHIPMENTS OF CHINA CLAY made during November last shows an increase of over nine thousand tons, compared with November, 1936. The port of Fowey was responsible for 53,814 tons of china clay, 2,783 tons of china stone, and 1,655 tons of ball clay, and 6,112 tons of china clay were sent direct by rail. The total tonnage dealt with in November last was as follows:—73,431 tons china clay, 3,454 tons china stone, and 1,655 tons of ball clay, against 64,314 tons of china clay, 4,148 tons of china stone, and 855 tons of ball clay for the corresponding month of 1936.

THE NEED FOR BETTER ACCOMMODATION for the department of chemistry at Liverpool Technical College was emphasised by Professor W. H. Roberts, Liverpool city analyst, when he presented prizes and certificates to students of the department on December 6. The following were among the principal prize-winners: British Association special prize, J. Ireland. Society of Chemical Industry prizes: special merit, D. F. Barratt, senior, A. R. Fraser, junior, J. V. Shepheard. Norman Tate memorial prizes: G. W. Brownlee and J. F. Barlow. Earl of Derby science prize, E. I. Greig.

ACCORDING TO THE BOARD OF TRADE RETURNS for November exports of chemicals, drugs, dyes, and colours were valued at £2,084,524, as compared with £1,828,179 for the November, 1936, an increase of £256,345. Imports were valued at £1,333,628, as compared with £1,041,670 for November, 1936, an increase of £291,958. Re-exports were £45,507. Exports of ammonium sulphate increased from £90,032 to £150,219; exports of tar oils, creosote oil, etc., show an increase from £44,674 to £129,385, of which £94,272 went to the United States. Exports of copper sulphate also increased, from £22,217 to £36,090.

THE ELECTROTOR DUST AND SMOKE METER, invented by Dr. S. C. Blacktin, has been made the double award of the Founders' Silver Medal and the Institute of Patentees' Silver Medal at the Coronation Exhibitions of New Inventions held at Sheffield and Leeds in October and November respectively. This instrument, as demonstrated at both exhibitions, places on countable record the particles of which dust and smoke dispersions are composed. It retains the countability of separate particles over what is said to be a phenomental range due to the embodied instrumental principles.

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2. at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Applications for Patents

MANUFACTURE OF TANNING MATERIAL, ETC.—G. Baggini, and F. and G. Bosio. (Italy, Dec. 12, '36.) 33827.

REMOVAL OF CARBONIC ACID from gas.—O. Bormann. (Germany, Dec. 5, '36.) 33401.

COMPRESSING OF METAL POWDERS.—R. Bosch, A.-G. (Germany, Dec. 7, '36.) 33777.

MANUFACTURE OF CAST RESINOUS ARTICLES containing metal parts. British Thomson-Houston Co., Ltd. (United States, Dec. 5, '36.) 33722.

MANUFACTURE OF PHOSPHATES.—Briton Ferry Chemical and Manure Co., Ltd., and J. P. Fraser. 33356, 33358.

SEPARATION OF VOLATILE ACIDS from salts.—Briton Ferry Chemical and Manure Co., Ltd. 33357.

STABILISED VINYL RESINS.—Carbide and Carbon Chemicals Corporation. (United States, Dec. 31, '36.) 33301.

MANUFACTURE OF HETERO-CYCLIC COMPOUNDS.—H. C. Carrington. 33745.

MANUFACTURE OF FUSED SILICA ARTICLES, ETC.—General Electric Co., Ltd., and J. H. Goodchild, and J. H. Partridge. 33986.

MANUFACTURE OF PIGMENTED ARTIFICIAL FIBRES, ETC.—W. W. Groves (I. G. Farbenindustrie.) 33352.

MANUFACTURE OF ISOCYCLIC COMPOUNDS.—W. W. Groves (I. G. Farbenindustrie.) (June 5, '36.) 33353.

REMOVAL OF RUST, ETC.—W. W. Groves (I. G. Farbenindustrie.) 33514.

WATERPROOFING OF TEXTILE MATERIALS.—W. W. Groves (I. G. Farbenindustrie.) 33691.

MANUFACTURE OF CONDENSATION PRODUCTS.—W. W. Groves (I. G. Farbenindustrie.) 33851.

MANUFACTURE OF PLASTIC MASSES.—W. W. Groves (I. G. Farbenindustrie.) 33852.

MANUFACTURE OF HYDROHALIDES of substituted isothioureas.—W. W. Groves (I. G. Farbenindustrie.) 33980.

MANUFACTURE OF FORMALDEHYDE MASSES.—W. W. Groves (I. G. Farbenindustrie.) 33984.

WATERPROOFING OF TEXTILE FABRICS, ETC.—E. B. Higgins. 33765.

THERMOPLASTIC MATERIALS.—G. N. Higgs. 33641.

PREPARATION OF ISOQUINOLINE DERIVATIVES.—C. A. Hornung. (Germany, Dec. 22, '36.) 33546.

MANUFACTURE OF CELLULOSE ETHERS and esters.—A. A. Houghton. 33746.

MANUFACTURE OF ACID WOOL DYESTUFFS.—I. G. Farbenindustrie. (Germany, Dec. 12, '36.) 34020.

MANUFACTURE OF PERSULPHATES.—Imperial Chemical Industries, Ltd., R. C. Cooper, and O. H. Walters. 33395.

MANUFACTURE OF HETEROCYCLIC COMPOUNDS.—Imperial Chemical Industries, Ltd. 33745.

MANUFACTURE OF CELLULOSE ETHERS and esters.—Imperial Chemical Industries, Ltd., and A. A. Houghton. 33746.

HYDROGENATION OF NAPHTHYLAMINES.—Imperial Chemical Industries, Ltd. (United States, Dec. 5, '36.) 33747.

MANUFACTURE OF RUBBER-LIKE POLYMERISATION PRODUCTS.—G. W. Johnson (I. G. Farbenindustrie.) 33726.

MANUFACTURE OF AGENTS containing therapeutically active substances.—G. W. Johnson (I. G. Farbenindustrie.) 33727.

CONVERSION OF COMPOUNDS of the acetylene series.—G. W. Johnson (I. G. Farbenindustrie.) 33728.

MANUFACTURE OF HIGH MOLECULAR WEIGHT ALDEHYDES, ETC.—G. W. Johnson (I. G. Farbenindustrie.) 33881.

PRESSURE HYDROGENATION or pressure extraction of solid carbonaceous substances.—G. W. Johnson (I. G. Farbenindustrie.) 33880.

MANUFACTURE OF VAT DYESTUFFS of dibenzanthrone series.—G. W. Johnson (I. G. Farbenindustrie.) 33882.

DEHYDRATION PRODUCTS of 1.4-butylene glycols.—G. W. Johnson (I. G. Farbenindustrie.) 33879.

MANUFACTURE OF ETHYLENE.—G. W. Johnson (I. G. Farbenindustrie.) 33994.

PREPARATION OF IMINO-ETHERS and amidines.—H. King. 33435.

PRODUCTION OF BENZENE-SULPHON-ALKANOL-AMIDE DERIVATIVES. E. Lilly and Co. (United States, January 23.) 33373.

PRODUCTION OF ALKANOL-AMINE SALTS of mandelic acid.—E. Lilly and Co. (United States, June 24.) 33374.

PRODUCTION OF BENZENE-SULPHON-HYDROXAMIDE DERIVATIVES.—E. Lilly and Co. (United States, January 23.) 33375.

ACTIVATION OF CHOLESTEROL.—E. Lilly and Co. (United States, January 18.) 33376.

CATALYTIC PRODUCTION OF HYDROCARBONS.—Metallges, A.-G. (Germany, Dec. 2, '36.) 33360, (Dec. 9, '36) 33361, (March 16) 33362.

MANUFACTURE OF CHEMICAL SUBSTANCES.—W. H. Moss. 33621.

MANUFACTURE OF ORGANIC, ETC., COMPOUNDS.—H. C. Olpin. 33821, 33919.

CHEMICAL HEATING COMPOSITIONS.—S. Parness. 33961.

MANUFACTURE OF AZO COMPOUNDS.—Schering, A.-G. (Germany, Dec. 30, '36.) 34021.

RECOVERY OF SOLVENTS.—W. M. Still and Sons, Ltd., and E. H. Still. 33490.

CATALYTIC SYNTHESIS OF HYDROCARBONS.—W. H. A. Thiemann (Metallges, A.-G.). 33363.

MANUFACTURE OF ORGANIC COMPOUNDS.—C. F. Topham, and H. C. Olpin. 33919.

COMPOUND FOR REMOVING, ETC., SCALE IN WATER-BOILERS, ETC. R. H. Turnbull. 33978.

MANUFACTURE OF ASBESTOS, CEMENT, ETC.—Turner and Newall, Ltd. (Eternit-Werke, L. Hatschek). 34023.

SEPARATION OF AMMONIA AND SULPHURETTED HYDROGEN.—Union Chimique Belge Soc. Anon, and J. Guillissen. 33759.

Specifications Open to Public Inspection

PROCESS FOR THE MANUFACTURE OF HIGHLY DISPERSED PIGMENTS. I. G. Farbenindustrie. June 1, 1935. (Addition to 32476/35. 475,882.

MANUFACTURE OF SOLID DIAZONIUM SALTS.—W. W. Groves (I. G. Farbenindustrie.) May 28, 1936. 475,942.

MANUFACTURE OF ORTHO-OZYAZO-DYESTUFFS.—I. G. Farbenindustrie. June 3, 1936. 2661/37.

PROCESS FOR THE PRODUCTION OF METAL COATINGS on stainless steel.—W. Pfeiffer, and E. Voos (trading as W. Pfeiffer and Co.). May 30, 1936. 9935/37.

PROCESS FOR THE DECOMPOSITION OF ORES containing tungsten and the like metals.—Staatl. Sachsische Huttenund Blaufarbenwerke. June 6, 1936. 12420/37.

PROCESS OF IMPROVING WORKPIECES made from metals of the iron group and their alloys.—I. G. Farbenindustrie. June 3, 1936. 12668/37.

MANUFACTURE OF ETHERS AND ALCOHOLS from olefins.—Standard Alcohol Co. June 6, 1936. 13945/37.

METHOD AND APPARATUS for the instantaneous gasefication of liquid fuel.—A. G. Diederichs. May 30, 1936. 14785/37.

PROCESS FOR THE MANUFACTURE OF UNSATURATED KETONES of the cyclopentano-polyhydrophenanthrene series.—Schering-Kahlbaum, A.-G. June 2, 1936. 15255/37.

CATALYSTS.—Baker and Co., Inc. June 2, 1936. 15299/37.

PROCESS FOR THE MANUFACTURE OF DRY ICE.—A. Argyriades. June 4, 1936. 15139/37.

PIGMENT PASTES.—I. G. Farbenindustrie. June 5, 1936. 15426/37.

PROCESS FOR INCREASING THE WETTING-OUT and penetrating action of strong alkaline solutions.—Chemical Works, formerly Sandoz. June 4, 1936. 15437/37.

PROCESS FOR THE PREPARATION OF ALKALI METAL NITRATES.—Soc. D'Etudes Pour la Fabrication et L'Emploi des Engrais Chimiques. June 5, 1936. 15556/37.

MANUFACTURE OF CELLULOSE ESTERS.—British Celanese, Ltd. June 5, 1936. 15640/37.

PROCESS FOR OBTAINING BERYLLIUM and beryllium-alloys.—Seri Holding Soc. Anon. June 6, 1936. 15761/37.

MANUFACTURE OF ACRYLOXY CARBOXYLIC ACIDS and their esters:—E. I. du Pont de Nemours and Co. June 5, 1936. 15779/37.

MANUFACTURE OF CASEIN from milk.—A. Ferretti. Aug. 28, 1935. (Divided out of 23053/36.) 33637/37.

PRODUCTION OF A COLLOIDAL SOLUTION OF CASEIN.—A. Ferretti. Aug. 28, 1935. (Divied out of 23053/36.) 33638/37.

PROCESSES FOR RENDERING CASEIN FIBRES INSOLUBLE.—A. Ferretti. Aug. 28, 1935. (Divided out of 23053/36.) 33640/37.

Specifications Accepted with Date of Application

PRODUCTION OF LIGHT-SENSITIVE LAYERS containing diazo compounds.—S. Sokal (Kalle and Co., A.-G.). March 2, 1936. 476,122.

ANODISING OF ALUMINIUM and its alloys.—Electro-Metallurgical Research Co., Ltd. (in Liquidation), S. Wernick, and V. F. F. Henley. April 29, 1936. 476,161.

RESILIENT PRODUCT, and method of manufacture thereof.—A. J. Borst, jun. May 2, 1936. 476,163.

DYEING OF FURS, pelts, and hair, and dyestuffs therefor.—M. Mendoza, G. S. J. White, and Imperial Chemical Industries, Ltd. May 27, 1936. 475,966.

PRODUCTION OF MALIC ACID and its compounds.—A. Weizmann. May 28, 1936. 476,109.

MANUFACTURE AND PRODUCTION OF COMPOUNDS of the phthalocyanine series. G. W. Johnson (I. G. Farbenindustrie.) May 29, 1936. 476,168.

MANUFACTURE AND PRODUCTION OF LEUCO ESTERS of dyestuffs of the anthraquinonyl-azole series.—G. W. Johnson (I. G. Farbenindustrie.) June 2, 1936. 476,298.

MANUFACTURE OF RED LEAD.—A. Wreschner. June 4, 1936. 476,238.

MANUFACTURE OF PHTHALOCYANINES.—A. Riley, and Imperial Chemical Industries, Ltd. June 4, 1936. 476,243.

MANUFACTURE OF SYNTHETIC RUBBER-LIKE MATERIALS.—B. J. Habgood, R. Hill, L. B. Morgan, and Imperial Chemical Industries, Ltd. June 4, 1936. 476,244.

TREATMENT OF POLYVINYL ALCOHOLS or their partial derivatives. Chemische Forschungsges. June 5, 1935. 476,314.

PROCESS FOR THE MANUFACTURE OF VAT DYESTUFFS.—I. G. Farbenindustrie. June 7, 1935. 476,255.

PRODUCING HYDROGEN PEROXIDE from solutions of percompounds.—H. Schmidt. June 22, 1935. 476,262.

PRODUCING HYDROGEN PEROXIDE.—H. Schmidt. Sept. 26, 1935. 476,263.

MANUFACTURE AND PRODUCTION OF SECONDARY MIXED ALIPHATIC-CYCLIC ALCOHOLS.—G. W. Johnson (I. G. Farbenindustrie.) June 26, 1936. 476,189.

DECOMPOSITION OF CELLULOSIC MATERIALS with the aid of hydrogen fluoride to yield products that are of low molecular weight up to the point of solubility in water.—J. Bohunek, H. Hoch, and G. Mayrhofer. Aug. 13, 1935. 476,191.

RUBBER DERIVATIVES.—Rubber Producers' Research Association, G. Martin, W. S. Davey, and H. C. Baker. Aug. 24, 1936. 476,269.

HIGH-VACUUM DISTILLATION.—Eastman Kodak Co. (Oct. 11, 1935.) 476,134.

CONCENTRATION OF LATEX.—Rubber Producers' Research Association. (E. Rhodes and C. Sekaran.) Oct. 22, 1936. 476,073.

DENITRATION OF WASTE SULPHURIC-ACID MIXTURES or dilute nitric acid.—W. Busching. Nov. 10, 1936. 476,136.

FERTILISERS containing citrate-soluble phosphate.—H. D. Elkington (F. Kerschbaum.) Dec. 24, 1936. 475,993.

INDIGOID VAT DYESTUFFS.—Soc. of Chemical Industry in Basle. (Dec. 31, 1935.) (Cognate Application 35834/36.) 475,994.

POLYAZO-DYESTUFFS.—Soc. of Chemical Industry in Basle. Jan. 9, 1936. 475,996.

METHOD OF PRODUCING GAS from oil.—T. Nagel. Jan. 12, 1937. 476,275.

MANUFACTURE OF DIAZO PREPARATIONS.—Soc. of Chemical Industry in Basle. (March 9, 1936.) (Samples furnished.) 476,143.

MANUFACTURE OF AN OIL-SOLUBLE RESINOUS MATERIAL and lubricating-oils.—Texaco Development Corporation. March 23, 1936. 476,281.

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

Syria.—A firm in Beirut wishes to obtain the representation, on a commission basis, of United Kingdom manufacturers of pharmaceutical products. (Ref. No. 401.)

Egypt.—The Commercial Counsellor to H.M. Embassy in Egypt reports that the Egyptian Minister of Public Health, Cairo, is calling for tenders for the supply and delivery of quantities of medicinal oils for the year 1938-39. Tenders should be addressed to the Director of Stores, Ministry of Public Health, Cairo, Egypt, by whom they will be received up to 10 a.m. on January 29, 1938. (Ref. T. 31473/37.)

Palestine.—A firm in Tel-Aviv wishes to obtain the representation, on a commission basis, of United Kingdom producers of citric and tartaric acid and Epsom salts. (Ref. No. 389.)

Chemical and Allied Stocks and Shares

THE small amount of business passing in the industrial and other sections of the Stock Exchange has resulted in a fairly general reaction in prices. With market conditions as at present, only a moderate amount of selling tends to affect prices sharply, and owing to holiday influences the decline in activity may continue for the time being. The lower prices which rule for shares of chemical and allied companies have to be considered in relation to the general trend of the share markets. It is generally felt that values have been reduced to levels which more than allow for any likely decline in the rate of industrial activity, and consequently some improvement is being anticipated when firmer market condifions obtain.

Imperial Chemical have declined 6d. to 35s.; Distillers are 102s. 3d. compared with 104s. a week ago. The interim dividend of the latter company falls to be announced next month, and it is generally expected it will be unchanged at 7½ per cent., as it is the Company's custom to leave all question of an increase until the final payment. Last year the total dividend was 22½ per cent. and this was covered by a good margin of profits. Associated Portland Cement, which are also on a 22½ per cent. dividend basis, were unchanged at 86s. 3d., there being little selling in view of the apparently generous yield offered. Pinchin Johnson were another relatively steady feature, and at 38s. 9d. they are within 3d. of the price current a week ago. British Aluminium continued to attract attention on market hopes that an increase in dividend to 12½ per cent. is in prospect; at 45s. 9d. the price is only a few pence down on balance.

Turner and Newall reacted sharply from 84s. 4½d. to 81s. 3d., but are now "ex" the dividend,, while British Oxygen declined from 87s. 3d. to 81s. 3d. Triplex Glass were also on offer and have lost 5s. to 47s. at the time of writing. Shares of iron and steel concerns were also out of favour. Dorman Long have declined from 35s. 9d. to 32s. 6d., despite the excellent impression created by the statements at the recent meeting. Consett Iron are 10s. 4½d., compared with 11s. 4½d. a week ago; and Babcock and Wilcox 42s. 9d., compared with 44s. 6d. Staveley were relatively steady at 56s. 6d.

International Combustion were firm around 105s. on the dividend statement, and Imperial Smelting at 13s. 6d. are within 6d. of the price current a week ago. B. Laporte changed hands around 90s. There was more activity in Sangers around 23s., the larger interim having encouraged expectations that the total dividend is likely to be at least maintained, although the directors point out that a larger total should not necessarily be anticipated. Boots Pure Drug were lower at 45s., but are now "ex" the quarterly dividend. British Drug Houses were inactive and have remained at 23s. 9d. United Molasses at 24s. 6d. have not held best prices, but came in for demand on any decline, the forward contracts, referred to in the recently-issued report, having led to general anticipations that the outlook for the current financial year is favourable.

British Plaster Board have been lowered from 30s. 3d. to 28s., but Alpha Cement at 35s. were steady. Wall Paper deferred shares lost 6d. to 37s., and Borax Consolidated deferred a similar amount to 27s. 3d. Fison, Packard failed to hold all last week's rally and are 35s. at the time of writing. Cooper, McDougall and Robertson were maintained at 32s. 6d., but were inactive. Interest attached to the dealings in the new ordinary shares of Lever Brothers arising from the merger of Unilever and Levers. Best prices were not held; at the time of writing it was 35s.

Oil shares were lower owing to the general market trend and a disposition to await the interim dividend announcements of the "Shell" and Royal Dutch companies, which fall to be made early next month.

Weekly Prices of British Chemical Products

DURING the past week there have been no important price changes to record in general chemical, rubber chemicals and wood distillation products and values for most items are on a firm basis. A fairly active interest has been displayed in forward buying, but the demand for general chemicals for near delivery has been on a moderate scale only. There are no special features to report and existing conditions are expected to prevail until the end of the year. Quotations for coal tar products continue unchanged at last week's levels and the market is exceedingly quiet.

Price Changes

Rises: Aluminium Sulphate; Potassium Dichromate (Scotland); Sodium Dichromate (Scotland).

Falls: Cadmium Sulphide; Cresylic Acid, Pale, 99/100% (Manchester); Nephthalene, Refined (Manchester); Pitch (Manchester).

MANCHESTER.—Moderately active conditions have been reported during the past week on the Manchester chemical market. Buyers continue to add to the contracts already placed for delivery over varying periods of next year, though it is doubtful if, in the aggregate, the volume of business so far placed is so substantial as it was this time twelve months ago. The general undertone so far as prices are concerned is steady. Here and there a falling off in the quantities being taken into consumption has been experienced, though much of this is attributed to seasonal factors. Among the by-products buying interest since last report has continued on quiet lines, but easiness has been less in evidence.

GLASGOW.—Business in general chemicals for prompt delivery has again been very quiet, both for home trade and export, but a good deal of interest is still being shown for contract supplies for 1938, the prices for which, generally, are rather dearer than the 1937 contracts. Potassium and sodium dichromates have increased in price.

General Chemicals

ACETONE.—£45 to £47 per ton.

ACETIC ACID.—Tech, 80%, £30 5s. per ton; pure 80%, £32 5s.; tech., 40%, £15 12s. 6d. to £18 12s. 6d.; tech., 60%, £23 10s. to £25 10s. MANCHESTER: 80%, commercial, £30 5s.; tech. glacial, £42 to £46.

ALUM.—Loose lump, £8 7s. 6d. per ton d/d; GLASGOW: Ground, £10 7s. 6d. per ton; lump, £9 17s. 6d.

ALUMINIUM SULPHATE.—£7 2s. 6d. per ton d/d Lancs. GLASGOW: £7 to £8 ex store.

AMMONIA, ANHYDROUS.—Spot, 1s. to 1s. 1d. per lb. d/d in cylinders. SCOTLAND: 10½d. to 1s. 0½d., containers extra and returnable.

AMMONIA, LIQUID.—SCOTLAND: 80°, 2½d. to 3d. per lb., d/d.

AMMONIUM CARBONATE.—£20 per ton d/d in 5 cwt. casks.

AMMONIUM CHLORIDE.—Grey galvanising, £18 10s. per ton, ex wharf.

AMMONIUM CHLORIDE (MURIATE).—SCOTLAND: British dog tooth crystals, £32 to £35 per ton carriage paid according to quantity. (See also Salammoniac.)

AMMONIUM DICHROMATE.—8d. per lb. d/d U.K.

ANTIMONY OXIDE.—£68 per ton.

ARSENIC.—Continental material £11 per ton c.i.f., U.K. ports; Cornish White, £12 5s. to £12 10s. per ton f.o.r., mines, according to quantity. MANCHESTER: White powdered Cornish, £16 10s. per ton, ex store.

BARIUM CHLORIDE.—£11 10s. to £12 10s. per ton in casks ex store. GLASGOW: £11 10s. per ton.

BLEACHING POWDER.—Spot, 35/37%, £8 15s. per ton in casks, special terms for contracts. SCOTLAND: £9 per ton net ex store.

BORAX COMMERCIAL.—Granulated, £16 per ton; crystal, £17; powdered, £17 10s.; extra finely powdered, £18 10s., packed in 1-cwt. bags, carriage paid home to buyers' premises within the United Kingdom in 1-ton lots. GLASGOW: Granulated, £16, crystal, £17; powdered, £17 10s. per ton in 1-cwt. bags, carriage paid.

BORIC ACID.—Commercial granulated, £28 10s. per ton; crystal, £29 10s.; powdered, £30 10s.; extra finely powdered, £32 10s. in 1-cwt. bags, carriage paid home to buyers' premises within the United Kingdom in 1-ton lots. GLASGOW: Crystals, £29 10s.; powdered, £30 10s. 1-cwt. bags in 1-ton lots.

CALCIUM BISULPHITE.—£6 10s. per ton f.o.r. London.

CHARCOAL, LUMP.—£6 to £6 10s. per ton, ex wharf. Granulated, £7 to £9 per ton according to grade and locality.

CHROMETAN.—Crystals, 2¼d. per lb; liquor, £19 10s. per ton d/d. station in drums. GLASGOW: 70/75% solid, £5 15s. per ton net ex store.

CHROMIC ACID.—9½d. per lb., less 2½%; d/d U.K.

CHROMIUM OXIDE.—11d. per lb.; d/d U.K.

CITRIC ACID.—1s. 0½d. per lb. MANCHESTER: 1s. 0½d. SCOTLAND: B.P. crystals, 1s. 0½d. per lb.; less 5%, ex store.

COPPER SULPHATE.—£21 7s. 6d. per ton, less 2% in casks. MANCHESTER: £18 15s. per ton f.o.b. SCOTLAND: £20 10s. per ton, less 5%, Liverpool, in casks.

CREAM OF TARTAR.—100%, 92s. per cwt., less 2½%. GLASGOW: 99%, £4 12s. per cwt. in 5-cwt. casks.

FORMALDEHYDE.—£22 10s. per ton.

FORMIC ACID.—85%, in carboys, ton lots, £42 to £47 per ton.

GLYCERINE.—Chemically pure, double distilled, 1.260 s.g., in tins, £5 7s. 6d. to £6 7s. 6d. per cwt. according to quantity; in drums, £5 to £5 13s. 6d.

HYDROCHLORIC ACID.—Spot, 5s. to 7s. 6d. carboy d/d according to purity, strength and locality.

IODINE.—Resublimed B.P., 6s. 4d. per lb. in 7 lb. lots.

LACTIC ACID.—(Not less than ton lots) Dark, 50% by volume, £21 10s.; by weight, £27 10s.; Pale, 50% by volume, £27; by weight, £32 per ton. LANCASHIRE: Dark tech., 50% by vol., £24 10s. per ton; 50% by weight, £28 10s.; 80% by weight, £50; pale tech., 50% by vol., £28; 50% by weight, £33; 80% by weight, £55; edible, 50%, by vol., £41. One-ton lots ex works, barrels free.

LEAD ACETATE.—LONDON: White, £31 10s. ton lots; brown, £35. GLASGOW: White crystals, £31 10s.; brown, £1 per ton less. MANCHESTER: White, £35 10s.; brown, £34 10s.

LEAD NITRATE.—£34 per ton for 1-ton lots.

LEAD, RED.—£32 15s. 0d., 10 cwt. to 1 ton, less 2½% carriage paid. SCOTLAND: £32 per ton, less 2½% carriage paid for 2-ton lots.

LITHARGE.—SCOTLAND: Ground, £32 per ton, less 2½%, carriage paid for 2-ton lots.

MAGNESITE.—SCOTLAND: Ground calcined, £9 per ton, ex store.

MAGNESIUM CHLORIDE.—SCOTLAND: £7 10s. per ton.

MAGNESIUM SULPHATE.—Commercial, £5 10s. per ton, ex wharf.

MERCURY.—Ammoniated B.P. (white precip.), lump, 5s. 11d per lb.; powder B.P., 6s. 1d.; bichloride B.P. (corros. sub.) 5s. 2d.; powder B.P. 4s. 10d.; chloride B.P. (calomel), 5s. 11d.; red oxide cryst. (red precip.), 7s.; levig. 6s. 6d.; yellow oxide B.P. 6s. 4d.; persulphate white B.P.C., 6s. 1d.; sulphide black (hyd. sulph. cum sulph. 50%), 6s. For quantities under 112 lb., 1d. extra.

METHYLATED SPIRIT.—61 O.P. industrial, 1s. 5d. to 2s. per gal.; pyridinised industrial, 1s. 7d. to 2s. 2d.; mineralised, 2s. 6d. to 3s. Spirit 64 O.P. is 1d. more in all cases and the range of prices is according to quantities. SCOTLAND: Industrial 64 O.P., 1s. 9d. to 2s. 4d.

NITRIC ACID.—80° Tw. spot, £16 10s. per ton makers' works.

OXALIC ACID.—£48 15s. to £57 10s. per ton, according to packages and position. GLASGOW: £2 9s. per cwt. in casks. MANCHESTER: £49 to £54 per ton ex store.

PARAFFIN WAX.—SCOTLAND: 3¾d. per lb.

POTASH CAUSTIC.—Solid, £35 5s. to £36 15s. per ton for 2-ton lots ex store; broken, £42 per ton. MANCHESTER: £39.

POTASSIUM CHLORATE.—£36 7s. 6d. per ton. GLASGOW: 4¼d. per lb. MANCHESTER: £37 10s. per ton.

POTASSIUM DICHROMATE.—5¼d. per lb. carriage paid. SCOTLAND: 5¼d. per lb., net, carriage paid.

POTASSIUM IODIDE.—B.P. 5s. 6d per lb. in 7 lb. lots.

POTASSIUM NITRATE.—Small granular crystals, £24 to £27 per ton ex store, according to quantity. GLASGOW: Refined granulated, £29 per ton c.i.f. U.K. ports. Spot, £30 per ton ex store.

POTASSIUM PERMANGANATE.—LONDON: 9¾d. per lb. SCOTLAND: B.P. Crystals, 9¾d. MANCHESTER: B.P. 10¾d. to 1s.

POTASSIUM PRUSSIATE.—6½d. per lb. SCOTLAND: 7d. net, in casks, ex store. MANCHESTER: Yellow, 6½d.

SALAMMONIAC.—Dog-tooth crystals, £36 per ton, fine white crystals, £17 10s. per ton, in casks, ex store. GLASGOW: Large crystals, in casks, £37 10s.

SALT CAKE.—Unground, spot, £3 to £3 10s. per ton.

SODA ASH.—58% spot, £5 17s. 6d. per ton f.o.r. in bags.

SODA, CAUSTIC.—Solid, 76/77° spot, £12 10s. per ton d/d station. SCOTLAND: Powdered 98/99%, £18 10s. in drums, £19 5s. in casks, Solid 76/77° £15 12s. 6d. in drums; 70/73%, £15 12s. 6d., carriage paid buyer's station, minimum 4-ton lots; contracts, 10s. per ton less.

SODA CRYSTALS.—Spot, £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags.

SODIUM ACETATE.—£18 per ton carriage paid North. GLASGOW: £17 15s. per ton net ex store.

SODIUM BICARBONATE.—Refined spot, £10 10s. per ton d/d station in bags. GLASGOW: £13 5s. per ton in 1 cwt. kegs, £11 5s. per ton in 2-cwt. bags. MANCHESTER: £10 10s.

SODIUM BISULPHITE POWDER.—60/62%, £20 per ton d/d 1 cwt. iron drums for home trade.

SODIUM CARBONATE MONOHYDRATE.—£15 5s. per ton d/d in minimum ton lots in 2 cwt. free bags

SODIUM CHLORATE.—£27 10s. to £32 per ton. GLASGOW: £1 11s. per cwt., minimum 3 cwt. lots.

SODIUM CHROMATE.—4½d. per lb. d/d U.K.

SODIUM DICHROMATE.—Crystals cake and powder 4½d. per lb. net d/d U.K. with rebates for contracts. MANCHESTER: 4d. per lb. GLASGOW: 4¼d. net, carriage paid.

SODIUM HYPOSULPHITE.—Pea crystals, £14 10s. per ton for 2-ton lots; commercial, £11 5s. per ton. MANCHESTER: Commercial, £11; photographic, £15 10s.

SODIUM METASILICATE.—£14 5s. per ton, d/d U.K. in cwt. bags.

SODIUM NITRATE.—Refined, £8 per ton for 6-ton lots d/d. GLASGOW: £1 12s. 0d. per cwt. in 1-cwt. kegs, net, ex store.

SODIUM NITRITE.—£18 5s. per ton for ton lots.

SODIUM PERBORATE.—10%, 9¼d. per lb. d/d in 1-cwt. drums.

SODIUM PHOSPHATE.—Di-sodium, £12 per ton delivered for ton lots. Tri-sodium, £15 to £16 per ton delivered per ton lots.

SODIUM PRUSSIATE.—[illegible]d. per lb. for ton lots. GLASGOW: 5d. to 5¾d. ex store. MANCHESTER: 4¼d. to 5d.

SODIUM SILICATE.—£9 10s. per ton.

SODIUM SULPHATE (GLAUBER SALTS).—£3 per ton d/d.

SODIUM SULPHATE (SALT CAKE).—Unground spot, £3 to £3 10s. per ton d/d station in bulk. SCOTLAND: Ground quality, £3 5s. per ton d/d. MANCHESTER: £3 12s. 6d.

SODIUM SULPHIDE.—Solid 60/62%, Spot, £11 5s. per ton d/d in drums; crystals 30/32%, £8 15s. per ton d/d in casks. MANCHESTER: Concentrated solid, 60/62%, £11; commercial, £8 10s.

SODIUM SULPHITE.—Pea crystals, spot, £13 10s. per ton d/d station in kegs.

SULPHUR PRECIP.—B.P., £55 to £60 per ton according to quantity. Commercial, £50 to £55.

SULPHURIC ACID.—168° Tw., £4 11s. to £5 1s. per ton; 140° Tw., arsenic-free, £3 to £3 10s.; 140° Tw., arsenious, £2 10s.

TARTARIC ACID.—1s. 1¼d. per lb. less 5%, carriage paid for lots of 5 cwt. and upwards. MANCHESTER: 1s. 1¼d. per lb. GLASGOW: 1s. 1d. per lb., 5%, ex store.

WHITE SUGAR OF LEAD.—£31 10s. per ton net.

ZINC SULPHATE.—Tech., £12 10s. f.o.r., in 2 cwt. bags.

Rubber Chemicals

ANTIMONY SULPHIDE.—Golden, 7d. to 1s. 2d. per lb., according to quality. Crimson, 1s. 6d. to 1s. 7½d. per lb.

ARSENIC SULPHIDE.—Yellow, 1s. 5d. to 1s. 7d. per lb.

BARYTES.—£6 to £6 10s. per ton, according to quality.

CADMIUM SULPHIDE.—7s. 3d. to 7s. 6d. per lb.

CARBON BLACK.—4¾d. per lb., ex store.

CARBON DISULPHIDE.—£31 to £33 per ton, according to quantity, drums extra.

CARBON TETRACHLORIDE.—£41 to £46 per ton, according to quantity, drums extra.

CHROMIUM OXIDE.—Green, 10½d. to 11d. per lb.

DIPHENYLGUANIDINE.—2s. 2d. per lb.

INDIA-RUBBER SUBSTITUTES.—White, 4¾d. to 5½d. per lb.; dark 4d. to 4½d. per lb.

LAMP BLACK.—£28 to £30 per ton del., according to quantity. Vegetable black, £35 per ton upwards.

LEAD HYPOSULPHITE.—9d. per lb.

LITHOPONE.—30%, £16 10s. to £17 5s. per ton.

SULPHUR.—£9 to £9 5s. per ton. SULPHUR PRECIP. B.P., £55 to £60 per ton. SULPHUR PRECIP. COMM., £50 to £55 per ton.

SULPHUR CHLORIDE.—5d. to 7d. per lb., according to quantity.

VERMILION.—Pale, or deep, 5s. per lb., 1-cwt. lots.

ZINC SULPHIDE.—£58 to £60 per ton in casks ex store, smaller quantities up to 1s. per lb.

Nitrogen Fertilisers

AMMONIUM SULPHATE.—The following prices have been announced for neutral quality basis 20.6% nitrogen, in 6-ton lots delivered farmer's nearest station up to June 30, 1938: November, £7 8s.; December, £7 9s. 6d.; January, 1938, £7 11s.; February, £7 12s. 6d.; March/June, £7 14s.

CALCIUM CYANAMIDE.—The following prices are for delivery in 5-ton lots, carriage paid to any railway station in Great Britain up to June 30, 1938: November, £7 10s.; December, £7 11s. 3d.; January, 1938, £7 12s. 6d.; February, £7 13s. 9d.; March, £7 15s.; April/June, £7 16s. 3d.

NITRO CHALK.—£7 10s. 6d. per ton up to June 30, 1938.

SODIUM NITRATE.—£8 per ton for delivery up to June 30, 1938.

CONCENTRATED COMPLETE FERTILISERS.—£11 4s. to £11 13s. per ton in 6-ton lots to farmer's nearest station.

AMMONIUM PHOSPHATE FERTILISERS.—£10 19s. 6d. to £14 16s. 6d. per ton in 6-ton lots to farmer's nearest station.

Coal Tar Products

BENZOL.—At works, crude, 9½d. to 10d. per gal.; standard motor, 1s. 3d. to 1s. 3¼d.; 90%, 1s. 4d. to 1s. 4¼d.; pure, 1s. 8d. to 1s. 8½d. GLASGOW: Crude, 10d. to 10½d. per gal.; motor, 1s. 4d. to 1s. 4½d.

CARBOLIC ACID.—Crystals, 7¾d. to 9d. per lb., small quantities would be dearer; Crude, 60's, 4s. to 4s. 3d., dehydrated, 4s. 6d. to 4s. 9d. per gal. MANCHESTER: Crystals, 9½d. per lb. f.o.b. in drums; crude, 4s. 2d. per gal. GLASGOW: Crude, 60's, 4s. 3d. to 4s. 6d. per gal.; distilled, 60's.

CREOSOTE.—Home trade, 6¼d. to 6¾d. per gal., f.o.r. makers' works; exports, 6⅝d. to 6¾d. per gal., according to grade. MANCHESTER: 5¼d. to 6¼d. GLASGOW: B.S.I. Specification, 6d. to 6¼d. per gal.; washed oil, 5d. to 5½d.; lower sp. gr. oils, 5⅜d. to 6¼d.

CRESYLIC ACID.—97/99%, 4s. 1d. to 4s. 6d.; 99/100%, 4s. 6d. to 5s. 6d. per gal., according to specification; Pale, 99/100%, 4s. 6d. to 4s. 10d.; Dark, 95%, 3s. 9d. to 4s. 2d. per gal. GLASGOW: Pale, 99/100%, 5s. to 5s. 6d. per gal.; pale, 97/99%, 4s. 6d. to 4s. 10d., dark, 97/99%, 4s. 3d. to 4s. 6d.; high boiling acids, 2s. to 2s. 6d. American specification, 4s. 3d. to 4s. 6d. MANCHESTER: Pale, 99/100%, 4s.

NAPHTHA.—Solvent, 90/160, 1s. 6½d. to 1s. 7½d. per gal.; solvent, 95/160%, 1s. 7d. to 1s. 8d., naked at works; heavy 90/190%, 1s. 1½d. to 1s. 3d. per gal., naked at works, according to quantity. GLASGOW: Crude, 6½d. to 7½d. per gal.; 90%, 160, 1s. 5d. to 1s. 6d., 90%, 190, 1s. 1d. to 1s. 3d.

NAPHTHALENE.—Crude, whizzed or hot pressed, £8 to £9 per ton; purified crystals, £18 per ton in 2-cwt. bags. LONDON: Fire lighter quality, £5 10s. to £7 per ton. GLASGOW: Fire lighter, crude, £6 to £7 per ton (bags free). MANCHESTER: Refined, £18 per ton f.o.b.

PITCH.—Medium, soft, 36s. to 38s. per ton, f.o.b. MANCHESTER: 35s. f.o.b., East Coast. GLASGOW: f.o.b. Glasgow, 35s. to 37s. per ton; in bulk for home trade, 35s.

PYRIDINE.—90/140%, 12s. to 14s. 9d. per gal.; 90/160%, 11s. to 12s. 6d. per gal.; 90/180%, 3s. 3d. to 3s. 6d. per gal. f.o.b. GLASGOW: 90% 140, 10s. to 12s. per gal.; 90% 160, 9s. to 10s.; 90% 180, 2s. 6d. to 3s. MANCHESTER: 12s. 6d. to 14s. per gal.

TOLUOL.—90%, 1s. 10½d. per gal.; pure, 2s. 3½d. to 2s. 4½d. GLASGOW: 90% 120, 1s. 10d. to 2s. 1d. per gal.

XYLOL.—Commercial, 2s. 2½d. per gal.; pure, 2s. 4½d. GLASGOW: Commercial, 2s. to 2s. 1d. per gal.

Wood Distillation Products

CALCIUM ACETATE.—Brown, £7 15s. to £8 5s. per ton; grey, £10 to £11. Liquor, brown, 30° Tw., 6d. to 8d. per gal. MANCHESTER: Brown, £9 10s.; grey, £11 10s.

METHYL ACETONE.—40-50%, £40 to £42 per ton.

WOOD CREOSOTE.—Unrefined 6d. to 9d. per gal., according to boiling range.

WOOD NAPHTHA, MISCIBLE.—2s. 8d. to 3s. 3d. per gal.; solvent, 3s. 6d. to 3s. 9d. per gal.

WOOD TAR.—£2 to £8 per ton, according to quality.

Intermediates and Dyes

ANILINE OIL.—Spot, 8d. per lb., drums extra, d/d buyer's works.

ANILINE SALTS.—Spot, 8d. per lb. d/d buyer's works, casks free.

BENZIDINE, HCl.—2s. 5d. per lb., 100% as base, in casks.

BENZOIC ACID, 1914 B.P. (ex toluol).—1s. 9½d. per lb. d/d buyer's works.

m-CRESOL 98/100%.—1s. 8d. to 1s. 9d. per lb. in ton lots.

o-CRESOL 30/31° C.—6½d. to 7½d. per lb. in 1-ton lots.

p-CRESOL, 34-5° C.—1s. 7d. to 1s. 8d. per lb. in ton lots.

DICHLORANILINE.—1s. 11½d. to 2s. 3d. per lb.

DIMETHYLANILINE.—Spot, 1s. 6d. per lb., package extra.

DINITROBENZENE.—7½d. per lb.

DINITROCHLORBENZENE, SOLID.—£72 per ton.

DINITROTOLUENE.—48/50° C., 8½d. per lb.; 66/68° C., 10d.

DIPHENYLAMINE.—Spot, 2s. per lb., d/d buyer's works

GAMMA ACID.—Spot, 4s. per lb. 100% d/d buyer's works.

H ACID.—Spot, 2s. 4½d. per lb. 100% d/d buyer's works.

NAPHTHIONIC ACID.—1s. 8d. per lb

α-NAPHTHOL.—Spot, 2s. 4d. per lb., d/d buyer's works.

β-NAPHTHOL.—9¼d. to 9¾d. per lb.; flake, 9½d. to 9¾d.

α-NAPHTHYLAMINE.—Lumps, 1s. per lb.; ground, 1s. 0½d. in casks.

β-NAPHTHYLAMINE.—Spot, 2s. 9d. per lb., d/d buyer's works.

NEVILLE AND WINTHER'S ACID.—Spot, 3s. per lb. 100%.

o-NITRANILINE.—3s. 11d. per lb.

m-NITRANILINE.—Spot, 2s. 7d. per lb. d/d buyer's works.

p-NITRANILINE.—Spot, 1s. 8d. to 2s. 1d. per lb. d/d buyer's works.

NITROBENZENE.—Spot, 4½d. to 5d. per lb., in 90-gal. drums, drums extra. 1-ton lots d/d buyer's works.

NITRONAPHTHALENE.—9½d. to 10d. per lb.; P.G., 1s. 0½d. per lb.

SODIUM NAPHTHIONATE.—Spot, 1s. 9d. per lb., 100% d/d buyer's works.

SULPHANILIC ACID.—Spot, 8d. per lb. 100%, d/d buyer's works.

o-TOLUIDINE.—10½d. per lb., in 8/10-cwt. drums, drums extra.

p-TOLUIDINE.—1s. 10½d. per lb., in casks.

m-XYLIDINE ACETATE.—4s. 3d. per lb., 100%.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(NOTE.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

JOHN McNICOL AND SON, LTD., Hounslow, manufacturing chemists. (M., 18/12/37.) December 6, £300 debenture to J. H. Grove, London, W.; general charge.

Declaration of Solvency Filed

MONSANTO HOLDINGS, LTD (formerly Monsanto Chemical Works, Ltd., and Graesser-Monsanto Chemical Works, Ltd.), London, S.W. (D.S., 18/12/37.) December 7.

New Companies Registered

S. Press (Chemists), Ltd. (334,501).—Private company. Capital £100 in 100 shares of £1 each. To carry on the business of manufacturers of and dealers in chemicals, gases, drugs, medicines, etc. Subscribers: Ernest J. Lowman, Amberley House, Norfolk Street, Strand, W.C.2; A. Webb.

Broncig, Ltd. (334,468).—Private company. Capital £100 in 2,000 shares of 1s. each. To adopt an agreement with Ernest Dutchman and to carry on business as manufacturers of and dealers in chemical, medical, toilet and pharmaceutical substances, preparations, etc. Directors: Ernest Dutchman (permanent), 301-2 Finsbury Pavement House, 120 Moorgate, E.C.2; Geo. P. Saunders.

Rayoid Manufacturing Company, Ltd. (334,450).—Private company. Capital, £5,000 in 20,000 shares of 5s. each. To carry on business as manufacturers and suppliers of celluloid acetate, nitro cellulose paints, lacquers, etc. Subscribers: Arthur J. Rush, 11a Sise Lane, E.C.4. Registered office: 79 Lombard Street, E.C.

Chemical Development and Marketing, Ltd. (334,597).—Private company. Capital, £100 in preference shares of £1 each. To carry on the business of manufacturing and retail analytical, organical, biological and industrial chemists, druggists and dispensers, etc. Subscribers: Jacob Lewin, 46 Tachbrook Street, S.W.1; Howard Piercy.

Woodpulp, Limited. (334,461).—Public company. Nominal capital of £10,000 in 10,000 shares of £1 each. To carry on the business of manufacturers of pulp, paper, cellulose and allied products, and all articles and substances derived therefrom; dealers in timber and wood, timber and wooden articles, chemical manufacturers and dealers, chemists, distillers, engineers, shipowners, warehousemen, wharfingers, etc. Subscribers: A. S. Cash, 43 Byron Avenue, Coulsdon, Surrey; Chas. H. Garrett. Registered Office: 48 Copthall Avenue, E.C.2.

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Company News

Cellon, Ltd., announce a dividend for the half-year ended December 31, 1937, on 6 per cent. cumulative preference shares. Warrants will be posted December 31.

International Combustion.—Final of 12½ per cent., making 20 per cent., less tax (same), and cash bonus of 10 per cent., less tax (same), for the year to September 30; £50,000 (same) to reserve.

Rugby Portland Cement have announced a dividend on the 6 per cent. cumulative preference shares for the half-year ending December 31 to all shareholders on register as at December 17.

Compania Salitrera Anglo-Chilena announce payment on January 1 of 2¼ per cent. on 4½ per cent. income first mortgage debenture stock to stockholders on register December 11, making 4½ per cent.

The Lautaro Nitrate Co., Ltd., are making a final payment of 2¼ per cent. on December 31 on first mortgage income debenture and first mortgage (Antofagasta) income debenture stocks to stockholders on register December 16, making 3¾ per cent.

Egyptian Salt and Soda Co. state that the profit for the year to August 31 was £E.69,771 (£E.70,789). Deduct general expenses £E.5,934 (£E.5,570), and renewals, etc., and depreciation £E.10,294 (£E.10,694), leaving net profit of £E.53,543 (£E.54,525). Dividend 11¼ per cent. (same); forward £E.1,276 (£E.2,335).

Steel Barrel Scammells and Associated Engineers, Ltd., have declared an interim dividend on the ordinary shares of 6 per cent., actual, less tax, on account of the year ending June 30, 1938, payable on January 8, 1938. This dividend compares with an interim dividend of 5 per cent. last year.

Westburn Sugar Refiners, in their report for the year ended September 30 shows profit £58,997 (£51,228); add amount brought in, £46,463, making £105,460; final of 11½ per cent., making 17½ per cent., tax free (same), and bonus of 2½ per cent., tax free (nil); general reserve, £10,000 (same); £44,710 forward.

National Fertilizers, Ltd., state that net profit for the year to June 30 amounts to £16,951; add balance brought forward £2,002, making £18,953. Dividend on 4¼ per cent. cumulative redeemable preference shares to June 30, 1937, takes £11,411, leaving available £7,542. The directors do not recommend a dividend on the ordinary shares.

The Lautaro Nitrate Co., in their report for the year to June 30 last, show that sales of nitrate accorded to the company applicable to new production rose from 370,362 metric tons to 416,654 metric tons. The iodine sales quota increased from 261,291 kg. to 301,159 kg. Net profits for the year to be distributed in accordance with the scheme of November, 1936, are £88,325 higher than in 1935-36 at £450,490.

The Bleachers' Association, Ltd., have decided to defer consideration of an interim payment on the preference stock until the accounts for the year ending March 31, 1938, are available. In June last six months' dividend was paid on this stock in respect of arrears to December 31, 1933. The last payment on the ordinary stocks was in 1929-30. The company has £2,487,500 of 5½ per cent. cumulative preference and £3,818,737 of ordinary stock in issue.

British Benzol and Coal Distillation, Ltd., in their accounts for the year to October 31, 1937, show profit of £78,738 (£42,506). After charging overhead expenses, bank and debenture interest, etc., making full provision for tax, and allowing £13,531 (same) for depreciation of plant, machinery and wagons, net profit is £56,765 (£18,785). To reserve, £20,000 (nil); to taxation reserve, £10,000 (nil); dividend of 10 per cent., less tax (nil), £9,375; and bonus of 2½ per cent., less tax (nil), £2,344; forward, £12,546.

The Timber Fireproofing Co., Ltd., in this report for 18 months ended September 30 shows net profit £10,150 (against £2,835 for year ended March 31, 1936); add balance brought forward £1,520, making £11,669; to general reserve, £4,000 (£1,000); to taxation reserve, £500 (nil); to processes improvement account balance written off, £1,110 (nil); directors' additional remuneration, £194; final dividend of 5 per cent., making 10 per cent. (against 5 per cent., for previous period); £1,685 forward.

Trinidad Consolidated Oilfields, in the first report for period ended September 30 shows operating profit £53,675, add sundry receipts £1,450, making £55,124; deduct rents of non-producing areas £3,167; amortisation of drilling expenditure £25,671; fire and loss of profits insurance, £813; London office expenditure, including directors' fees, etc., £8,706, leaving net profit (subject to tax), £16,768 to be carried forward. Capital expenditure for year, including cost of drilling new wells, £153,066.

The Anglo-Chilean Nitrate Corporation (Compania Salitrera Anglo-Chilena) state that operations for the year ended June 30, 1937, have resulted in a substantial improvement in the company's position as compared with the preceding year. Distributable net profits for the year amounted to £426,814, compared with £363,290 for the preceding fiscal year. Of this amount £212,241 will be paid out in interest at the rate of 4½ per cent. on both the sterling first mortgage income debenture stock and the dollar issue of sinking fund income debentures.